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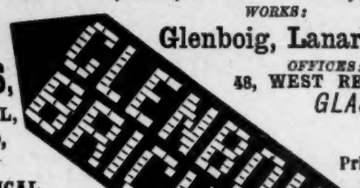

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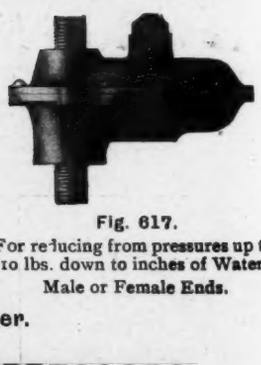

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EDITORIAL NOTES.

War Problems and Lessons.

IN every part of the gas industry of the United Kingdom, the effects of the war have been common in kind; but geographical location and pre-war conditions and practices have produced from each quarter of the kingdom a greater intensity of effect in one or other respect. Take the Metropolis and South Coast towns with their freight difficulties and costs, take the inland parts distant from the coalfields with their long railway journeys and troubles in regard to irregular and short deliveries; take Ireland with its high freights and very erratic supplies, and comparatively, in the majority of cases, poor districts incapable of paying excessively high prices for gas; then take Scotland, with its penchant for high illuminating power gas, which is antagonistic to the present-day requirement for benzol and toluol, and the prospective development of the work of the industry. It is instructive to watch the variations of experience, to notice the differences in character of incidental problems, and to remark how they have been, and are being, dealt with. It is also interesting to observe how inexorable circumstance has everywhere in the industry quickened and brought into larger application the capacity for adaptability. We have learned much of the differences engendered by locality and pre-war conditions and practices through presidential addresses—particularly through the one recently delivered to the Irish Association, and last week through that delivered to the North British Association by Mr. Alex. Masterton, Engineer and Manager of the Edinburgh and Leith Corporations' Gas Commissioners' undertaking. The latter was a clear exposition of the new state that, owing to the war, has arisen in the gas industry, as experienced in Scotland, and as seen by observation of the trend of things generally; also, of how, in one part, that new state is hastening the gas industry to the adoption of a larger policy, and one that will show a greater flexibility in meeting the conditions of the future, for any expansion of business that increases its diversity, whether it be through gas or residual products, is an inestimable strength.

Outstanding considerations have been coal and oil, the washing of gas for the extraction of benzol and toluol, and in some cases difficulties with labour. And there have been financial anxieties, and incidental working troubles (such as with naphthalene), which have called for solution of a more or less drastic and imperative nature. The first three subjects formed the main part of Mr. Masterton's address; but, in the reverse order, which indicates that labour for him has perhaps been more harassing than the question of coal and oil. The big gaps made in the ranks of the industry's men by enlistments do not constitute the only labour question that has vexed the minds of responsible gas engineers and managers. In some quarters still more troublesome have been the dissolute thought and rule of the leaders of labour, who take any and every opportunity for fomenting discord, and achieving distinction among their following by squeezing out of employers further additional gain. The morality of the action in stressful times, when the rank-and-file of labour, in loyalty to themselves, their employment, and their country, should be helpful, and not otherwise, causes no disturbance in the minds of these men. There has been an unpleasantly large crop of this sort of thing—particularly in municipal concerns. We are convinced the trouble has not had its origin among the men generally, but in the brains of those who direct the work and the fortunes of the unions, while the composition of the local governing bodies supplies media for more effective operation on the part of these men than that of the administrations of private bodies. The Edinburgh and Leith Gas Department has had its load of difficulty through unconscionable demands; and the gas-works have had to be placed under Government control. Yet the Commissioners have good record as generous employers. At the beginning of the war, they were not backward in looking after those who enlisted and their dependants; and they have not been slow in helping to assuage the burden of the increased cost of living. It is a traditional merit of the gas industry that at all times it looks well after its own people. And it is not, as are so many other traders, profiting by the war; it profits better in normal times. Therefore, the more regrettable is it that unrest among the men in municipal gas service should have, all too strikingly, manifested itself during the war through outside stimulation, and not only in regard to wages, but conditions of work. Trade union law is so inflexible, and must remain so inviolate, that it can make no allowances for temporary differences, even though due to war upon an unparalleled scale, and with issues of unprecedented importance. Little things have been magnified, and have caused endless worry, when collaboration and the principle of give and take should, if ever, have had full sway. That other conditions have obtained is exceedingly deplorable. But out of evil good may come. We believe that light is penetrating even into some of the dark places of trade union obstinacy, and is promoting the knowledge that the common cause of the country and of the workers demands not only unity in sections, but unity between all sections of the industrial organization, for co-partnership is a material and potential fact. We sincerely hope the future will show that the belief is not ill-founded.

Another imposing section of Mr. Masterton's address was that in which he treated of the development in the gas industry's operations that has been made compulsory by the war—that is, the washing of gas for the recovery of benzol and toluol. But in some of his remarks we rub shoulders with that old fetish (in some quarters of Scotland's gas administration) of high illuminating power, and with the question of the necessity of enrichment due to the removal of illuminating constituents, and in minor part of calorific value. But while giving these things consideration, the President discloses his progressive mind, and the view that herein is a fresh direction in which to consolidate the interests of the industry by adding something new to that diversity of process and business which inures to strength, and helps to enlarge compensatory advantage in some markets when there is a depression in others. But upon this more presently. The war is forcing experience in a powerful way. It compels the extraction of benzol and toluol; it has produced a great shortage and a high cost of the very materials that are now necessary for enrichment if it be required. *Ergo*, while the extraction must go on, the enrichment must as far as possible be done without. And when the President informs those who heard his address, as well as those who now read, his remarks that, washing a 16 to 17 candle coal gas with low-grade tar or creosote oil, the illuminating power was reduced approximately to 10½ candles, or 34½ per cent., while the calorific value was reduced by only 4·5 per cent.—from 585 to 559 B.Th.U.—he supplies figures that are directive to any intelligent mind. Hence the goal on which he has set eyes. "It appears to me," he said, "that "the bulk of the consumers will benefit largely, as, with the "lower quality of gas, we should be able—again assuming "that coal prices return somewhere near the normal—to "manufacture and distribute it at much less cost; and it "would be unfair to the majority to keep back such a pro-"gressive movement merely because a small percentage of "the consumers would be adversely affected, and those on "account of the use of obsolete appliances." What is lost (such as it is) in B.Th.U. can be made up by efficient appliances and efficient use; for while consumers cannot be expected to apply with laboratory precision any fuel for heating, we all know that there is a large margin existing from which to extract a higher efficiency between their

methods of use and proper use. In the way Mr. Masterton gives utterance to his views on the revision and extension of policy, in this connection, there is caution of the true Scotch brand; but there is also a transparency about his words which reveals an actual settlement of opinion. Thus we see that under all the circumstances, he is "almost" persuaded that, where agreements exist for the acquisition at the end of the war of benzol-recovery plant erected by the Government, the acquisition will prove remunerative.

There is the greater need for every development of business and income owing to the impossibility of estimating future financial results on the old standards of peace-time outgoings for raw materials, goods of all kind, labour, taxes, and so on. We shall have peace again; and the sooner the better, so long as the purpose of the Allies is achieved. But with the restoration of peace, costs are not going to return with any great alacrity to the degree of those of pre-war times; and so sulphate of ammonia derived from the carbonization of coal is likely to suffer more stringent competition. Some of our readers will not be astonished to find that before long plant is in actual operation in this country for utilizing the nitrogen of the atmosphere in the production of fertilizers. Here again are reasons for enhancing the profit from gas works residual products, by the producers taking a larger part in developing them in view of the prospects in regard to dyes, motor fuels, explosives, and the promotion of a more economic use of coal. The percentage of return produced by residuals upon the cost of coal must be enlarged as much as possible. What the percentage has been in the case of Edinburgh in each of the five years before the war, and during the war period, supplies further interesting topic in Mr. Masterton's address; and the data are worth study. They illustrate the necessity of, while commonsense advises, any departure from old ways which offers advantage in respect of residuals. In dealing with the question of coal, the President referred to the benefits realized (and recommended other gas undertakings to secure them) by the ownership of waggons equal to carrying one-third of their coal requirements.

To sum up, in the movements that have been fostered by the war, there have been pointed out the means of widening the field of usefulness, and so enhancing the stability and prosperity of the gas industry. And the chief thing against which those responsible must guard is the neglect of such opportunities as now present themselves.

High-Pressure Lighting Developments.

"A HIGHLY interesting, and, to my mind, far-reaching "development in connection with high-pressure lighting." With these words, Mr. Masterton, in his North British Presidential Address, introduced an invention in high-pressure illumination which, in all probability, will have an important bearing in increasing the scope and utility of this method of lighting in factories and workshops. In many factories, the atmosphere contains a considerable quantity of dust and other particles which, through their indrawal by the burners, are the contrary of beneficial to the maintenance of the efficiency of high-pressure lamps; and this drawback has been, in such places, to the advantage of electric lighting. The problem has been very successfully attacked by the James Keith and Blackman Company; and it has had proof in an installation at the works of the North British Rubber Company. It has resulted in considerable economy of gas—to the extent of 40 per cent.—and, dusty atmosphere notwithstanding, the efficiency of the lighting has been upheld, although small units are employed. The new method of installation is known as the "Duct" system. In this a special duct is run through the building, conveying fresh air from the outside. The high-pressure gas is coupled-up at various points in the length of the duct; and each of the connections supplies, by means of one injector (this is a notable feature), a number of high-pressure burners—four, six, or eight as the case may be. The injector is of large capacity; and therefore not liable to choke. It draws in the correct quantity of fresh air from the duct; and the mixture of gas and air is forced along a pipe ¾ inch to 1 inch in diameter, to which the burners are attached in the required positions. It is seen from this that the air supply for the burners is quite independent of the dust-laden atmosphere of the factory; and that the use of a single injector for the supply of a number of burners connected up with the tube containing the mixture will enable, we should imagine, the use of units smaller than 75 to 80 candle power, which with Edinburgh gas is realized, under the "Duct" system, from a consumption per burner of 1½ cubic feet per hour. In factory lighting, when no consideration is given to the question of eye-impairment caused by the high intrinsic brilliancy of so-called "half-watt" electric lamps, nor to the quality of the light, the gas industry will require improvements like the one under notice to prove to some factory owners that economy and maintenance of efficiency still rest with gas lighting, and supplement the qualities of reliability and a relatively low intrinsic brilliancy.

Organizing the Gas-Furnace Business.

THE gas industry is at the flood-tide of its opportunity in connection with gas-furnaces. In most munitions work, a capacity and an efficiency have been proved that previously were not within the cognizance of many factory owners requiring heat. Although there are just now obstacles to business development, the future claims that present opportunities should not be lost even at some little sacrifice. If, in this connection, there are any managers in charge of gas undertakings in industrial areas who need a little energizing, no better advice can be proffered to them than that they should carefully peruse the paper that Mr. Ralph Halkett read before the North British Association last Friday—beginning with the final table and succeeding paragraph, and then turning back to the commencement of the paper and reading steadily on. If anything will induce interest in the subject, it is the table in question and the accompanying paragraph. All cities and towns have not the scope for gas-furnace application that Glasgow now possesses; but no gas undertaking in an industrial district need leave untouched the business that does offer. The table shows that recent installations of gas-furnaces in Glasgow number 44, and that these furnaces represent a daily consumption of 283,000 cubic feet of gas. In these two figures there is certainly abundant incentive for serious attempts being made to develop this class of business where hitherto there has been no movement. Upon the figures, the Glasgow Gas Department are to be congratulated.

While Mr. Halkett's paper is somewhat long, justification for this protrudes from every part, on account of the assistance it will be in the matter of guiding to safe lines the manager who is contemplating starting a gas-furnace branch, on account of the sound advice it contains for the officer in charge of the business, and on account of the data drawn from practical working experience, and not from experiments surrounded and protected by the refinements of the expert supervisor. The data from the latter usually show what can be done; that from working experience what is done. And what is done, as exhibited by Mr. Halkett, is highly satisfactory, and cannot be rejected by any manufacturer who has a care for his own interests. It is a fertile field that offers; but there is not any field that claims from the gas manager more careful cultivation. Scientific lighting, with its requirement of a certain quantity of illumination measured as foot-candles at a certain level, and varying for given purposes, is a comparatively simple matter compared with this; so is the gas cooking business; so is room-heating by gas; and even the hot-water circulating business does not present the same diversity. Industrial heating is a science and art apart. Therefore it is a business that, if there is the scope in a district, demands a technically trained expert, and one with the capacity for speedily grasping the special requirements in every branch of industrial heating work with which he may be brought into contact.

"Get your man before doing anything else," is the advice of Mr. Halkett. The least troublesome plan is to apply for such a man to the makers of gas-furnaces. But it may not be the most prudent. There is in the paper counsel against this course. In the interests of the gas supply undertaking, the head of the gas-furnace department must be, above all things, a man of strict impartiality. The plan advised is to select a man of capacity, with technical knowledge of gas applications, and have him specially trained for the work. It is to the interest of the gas-furnace manufacturers themselves to have men who are free from all bias at the head of such departments of gas undertakings; and it is to their interest, too, that such men should have practical knowledge of the construction, fitting, and operation of their furnaces. The manufacturers' own success depends upon the proper utilization of their goods. This being so, Mr. Halkett suggests that the man selected for this work should be trained by a short experience in the workshops of each of the

makers of furnaces, so as to obtain first-hand knowledge of construction, fitting-up, and operation of all types. Lines of study are also mapped-out. With such a trained man, a gas undertaking, with the prospect of substantial industrial heating business before it, would have the right person at hand to organize the new department, and to fit up the next necessary—that is, a demonstration room, where tests can be made of new productions, where experimental work can be carried on to ascertain what is best for each customer's requirements, and where both service and efficiency can be demonstrated to manufacturers with their own metal or class of work. The qualifications of the expert head of the department must include diplomacy, when dealing with manufacturers hardened in old methods by custom and experience. Postulation and dogmatism must be avoided. Claims, too, should have a margin of safety attached; and care should be taken not to put upon gas-furnaces duties which can be more economically performed by some other means. For example, in the heating of steel plates of small dimensions, the results with gas are economical and satisfactory; but it does not follow that gas should always be recommended for plates of larger size, unless there happens to be a considerable amount of work to be done. It would have been well if Mr. Halkett had brought into juxtaposition with his practical views on the training of an expert for the gas-furnace department (which views we consider highly important) the batch of "Dont's" which are thrust away towards the end of the paper; for every one of them constitutes a safeguard to be remembered and acted upon.

There is no need to comment upon the figures presenting actual working experiences in Glasgow factories. They all show a saving in time, in fuel, in floor space, in addition to convenience, cleanliness, reliability, and constant heat value of the fuel, which mean money. All comparative total cost figures for a given amount of work require qualifying if the work is accelerated by the use of gas. If more work can be done in a given time, under the same conditions of labour and space, then relative costs for a stated quantity of work do not tell the whole tale. For instance, in one case quoted by Mr. Halkett, he shows a saving of money, but the output was increased by 50 per cent. His remarks on temperature control by pyrometers and standard pyramid cones are important; as also are the references to the necessity of obtaining a proper proportionate mixture when gas is used at normal and air under pressure. In this latter connection, he alludes to the mixer which he has introduced, and which he is satisfied accurately proportions the gas and air, and realizes an intimate admixture.

Of course, in developing the industrial uses of gas, a market for coke is being trenched upon. But this cannot be helped. Economy in other industries through gas assists in consolidating the interests of the gas industry in respect of its primary commodity, and this is the matter of chief importance. There are other fields for the use of coke that have not been fully explored—such as steam-raising and domestic use. The fuel economy campaign that is now proceeding should be of great advantage to coke; and this is another direction in which the gas industry should show an active and not a passive interest.

Gas Undertakings as Electricity Suppliers.

THERE is little opportunity at this time of day for gas undertakings to become public suppliers of electricity, other than in the restricted areas that have been left in the background by the promoters of electrical concerns. Perhaps Scotland presents relatively more opportunities than England, which is fairly well covered now, excepting in the smaller towns and rural districts. However, that there is positive economy to be derived from a combined supply of gas and electricity is strikingly shown by the paper that Mr. J. W. Napier, of Alloa, read at the North British meeting; and he writes from an experience now of some years' duration. But, of course, the author's experiences can only be taken as illustrations of what might be accomplished in towns similarly circumstanced. For instance, the character of the power load and its proportion to the lighting load show that his plant is kept running on terms that are contributory to economy; and that this is a condition that does not always obtain, electrical engineers know from painful experience, even in places of the size of Alloa.

An interesting point about the paper is that Mr. Napier uses suction-gas plant and gas-engines for generating purposes. The Tottenham Light, Heat, and Power Company for their generating station utilize their own gas, and not producer gas of any kind. It would have been interesting if Mr. Napier had explained why, at the outset, he did not adopt town gas (he is supplying it to others for power purposes at 1s. 4d. to 1s. 10d. per 1000 cubic feet), instead of building-up his units of plant piecemeal upon the suction-gas plan, with, in contemplation now, a Mond producer gas plant, with ammonia recovery, which is going to provide additional working economy through the utilization of the gas for the heating of the retorts. In the suction gas plant, coke is used; and it is also proposed to supply it as the fuel in the Mond producers, thus providing a good market for one of the products of gas manufacture, and preventing the waste of the nitrogen content of the coke. Clearly, this will be an advantage. But in comparison with the use of town gas, the suction-gas plant costs money; and expenditure must be incurred in its repair, maintenance, and renewal. The suction-gas plant entails more labour than the use of town gas; and, although utilizing coke, the suction gas claims (unless vertical retort coke is available), so Mr. Napier states, care in cleaning from all traces of tar, which causes trouble with the engines. Mr. Napier speaks as though this would be the case with all horizontal retort coke; but the trouble, it may be suggested, would be controlled somewhat by the character of the coal and the degree to which it was carbonized. The point, however, is that there are a good many factors to be taken into account with suction gas as compared with town gas delivered purified to the engines. Besides all this there is some value in demonstrating the virtues of town gas as a power agent, and not the working of a gas plant which may not always be used by others with coke as fuel. At the same time (our electrical friends should note what is being done in the provision of electricity by a gas undertaking with coke), Alloa is doing remarkably well in the matter of costs—0·9d. per unit (of which fuel costs 0·23d. per unit, with coke at 13s. per ton), including fuel, oil, waste, water, wages, repairs, maintenance, rents, rates and taxes, management, office and legal expenses, and insurance of plant. And the net fuel cost is likely to come lower still, when the plan (which reminds of Mr. F. D. Marshall's scheme as referred to elsewhere in this issue) of the Mond producer is an accomplished fact, and gas made from coke is being used for retort heating as well as for generating electric current, with ammonia recovery thrown in.

Mr. Napier deserves congratulations for the success that has attended the scheme, which is another illustration contributing to the confusion of those electricians who use the hoary and now discredited argument, that gas undertakings empowered to supply electricity will not, though making the capital investment, do anything to give the electricity undertaking a fair chance. Every electricity supply plant run by a gas company proves the contrary. Here at Alloa, we have an electricity undertaking that (while the gas concern pursues a prosperous career) has increased its private lighting units since 1911 from 55,460 to 135,821, its power units from 13,922 to 642,347, and its total sales, including public lighting, from 98,320 to 780,963 units. Can the electricians show another town of equal size and opportunities where the expansion has been at a faster rate, or where the concern is run more economically? Mr. Napier invites controversy on the question of low power charges in relation to the higher lighting charges per unit. It is a question that involves many factors, and cannot be argued in brief space. We will therefore merely point out that he takes the works charges concerned in the actual cost of each unit sold, and says: "Making the cost per unit 0·6d., there is a sufficient "margin left; and on a sale of (say) 100,000 units per "annum, the surplus would be fully £80." Upon this, it can be submitted (though we have no means of dissecting the actual working charges, and allocating them between power and lighting) that the 135,821 units sold for private lighting contribute more to the discharge of the obligations (shown in the paper) in respect of interest and sinking fund than the 642,347 units sold for power. The paper is an excellent contribution to the general subject, and a testimony to the foresight that in Alloa combined the gas and electricity supplies in one undertaking.

Mr. Marshall's Vision.

Everybody, except electrical people, is agreed that the gas industry has an enormous field of usefulness before it, and that it is destined to take a larger place in the world than ever before.

Mr. F. D. Marshall is also of this view; but he appears to be of opinion that the future is wrapped up in low-temperature carbonization, with the subsequent gasification of the coke, and the recovery from it of the now wasted ammonia. Low-temperature carbonization has not hitherto attracted much support, and has not produced any luxuriant returns for those who have invested money in it. True, the Government were lately attracted, and put a solid sum into one of the processes. But the Government have dropped the little piece of adventure like a piece of incandescent coke, because they are now satisfied there is nothing beneficial in it from their or the national point of view. The gas industry has not taken up low-temperature carbonization, because neither Mr. Marshall nor anyone else has convinced the responsible men at the head of the industry that there is in it anything material for them. When the Gas Light and Coke Company produced coke with a larger proportion of volatile matter in it than in ordinary gas coke, the public did not make sufficient demand for it to justify the continuation of the waste of even the additional proportion of volatile matter. Now Mr. Marshall, in an article in "The Times Engineering Supplement," does not, though a low-temperature advocate, give much consideration to the people who may want to use solid fuel. He proves by calculation the wickedness of the waste that proceeds on the domestic hearth, and says that, if people require a solid fuel, then they should be induced to use one from which the tarry and smoky matters have been removed. But under his scheme, he is not proposing to leave them any such fuel to use. The real solution of the problem of the economical use of coal is, he says, only by first treating all raw coal either by the existing high-temperature processes should much gas and benzol products be required, or by low-temperature processes should the production of gas be a secondary consideration, and spirit and oils the first desideratum. If Mr. Marshall is, under his scheme, going to rob the people entirely of solid fuel, then they must have an alternative fuel; and it seems to us that gas will then be the primary desideratum, and high-temperature carbonization will prevail.

The Coke to be Gasified.

Then Mr. Marshall tells us that the coke should be in either case gasified in "producers" for making power gas; and this should be converted into electricity. The recovery of the ammonia, he says, would practically pay for the cost of gasifying the coke; so that this means there would be to all intents and purposes gas for electricity generation for nothing. Of course, we know Mr. Marshall has had an intimate association with the developing of a process for the utilization of nitrogen from the atmosphere. Perhaps he can tell us something as to the probable effect of these processes upon the future of the sulphate market; and perhaps he can also tell us whether a plant of the kind is going up in this country, or if one is likely to be constructed. That, however, by the way. Each ton of coke gasified, Mr. Marshall points out, would yield about 130,000 cubic feet of power gas of 130 to 140 B.Th.U. Every 130 cubic feet of this gas, when used in a good gas-engine would yield a unit of electricity; and 200 cubic feet when burned under boilers would provide steam for a turbine-driven plant, and thereby a unit of electricity. By these means, he estimates it would be possible to deliver electricity in bulk at 0·062d. per K.W. hour. "This would bring electrical heating and lighting within the reach of *all*."

Not Much Left for the Gas Industry.

Now if electricity is going to be used by "all," we cannot see that they would spend money at the same time on gaseous fuel. So the gas industry would not have much left on which to live. But Mr. Marshall is good-natured, and does not desire to hurt the feelings of his old love, the gas industry. Although electricity under his scheme would be within the reach of "all," "the gas companies would not," he says, "suffer by the loss of revenue from the sale of illuminating gas. Their future lies in the distribution of gaseous fuel which they could continue to carry out from their existing plants. But, if instead of exporting vast quantities of coke, as they did before the war, they would gasify the coke (recovering the ammonia), they would be in a position—the necessary statutory powers being assumed—either to supply cheap electricity themselves, or to provide cheap gaseous fuel to the existing electrical companies." In proportion to the coke produced, the gas industry was not exporting "vast" quantities of coke before the war; the Board of Trade returns attest this. As to obtaining statutory powers for the supply of electricity, all the best fields are covered by undertakings with full statutory authority; and the electricity industry does not appear enamoured of the idea of relying on their competitors for gaseous fuel, though there is a disposition to take more coke, and to consume it under steam-boilers with forced draught. The late Professor Vivian B. Lewes was once on much the same lines as Mr. Marshall is now. The latter gentleman, however, is not prepared to speak too assertively on the subject of the financial success; for he is not sure of the public. "With cheap electricity and cheap gaseous fuel supplied by the gas companies, the public could *possibly* be weaned from their appallingly wastefully open grates." "Possibly!" It is a pretty and fascinating scheme, with a formidable barricade of "buts" and "ifs" about it.

Execution of Works after the War.

There will be many knotty points to unravel at the close of the war; and it will therefore be well, wherever possible, to make an early start with putting in train for solution such problems as seem likely to present themselves. Views remain as diverse as ever with regard to the probable duration of hostilities; but for the purpose of looking forward in some respects to the return of peace, it is not necessary to know just when it will come. It is, for instance, quite obvious that at the close of the war important questions will arise in connection with the demand for capital and the distribution of employment; and it is satisfactory to note that the President of the Local Government Board has in contemplation the collection of data necessary for the elementary consideration of these problems—more particularly the data likely to vary least with the progress of time. The idea is to establish a register of work available and likely to be undertaken at the conclusion of the struggle; and it appears to Mr. Walter Long—so the official intimation runs—that, while by no means excluding other sources of information, this can to a large extent best be compiled from particulars which local authorities may possess or be able to obtain, as regards both works to be undertaken by them and others to be carried out in their areas. Forms are therefore sent to the clerks of local authorities to be filled in—it being felt that the advantage of taking time by the forelock in the matter of the preparation of the statistics asked for justifies the additional labour which the compiling of them will impose upon officials at a time of hard work with depleted staffs. It is, of course, fully recognized that, with so many uncertainties as to future conditions, absolute exactitude in stating what work will be done is out of the question—more especially as regards any to be undertaken by private enterprise—and it is stipulated that "the inclusion of particular works in the register cannot in any way bind the undertakers to proceed with those works." Many urgent schemes will have to be put in hand in any event; but others will depend upon factors which cannot be determined until after the war.

Assisting the British Workmen.

While the circular just alluded to admits the impossibility of accurately forecasting what the position of things will be when peace arrives, the remark is made that "there seems every reason to anticipate that plenty of labour will be available for almost every class of work." This brings to mind an appeal which Mr. A. M. Paddon has recently been making, at meetings of gas companies with which he is connected, for the support of British industries after the war. At the meeting of the Brighton and Hove General Gas Company on Friday last (a report of the proceedings at which appears in this issue), it will be seen that he went somewhat fully into this question. The views enunciated must appeal to those to whom they are addressed; and it is of interest to note that a point made by him is the very one which the sentence quoted from the Local Government Board circular hints at. That is to say, the problem to be met is likely to be more one of finding work than of finding labour. In his position as chairman of several gas companies, Mr. Paddon has declared the resolve of those undertakings for the future to purchase nothing coming from the countries now at war with Great Britain and her Allies, and to transact business with neutral countries only when it cannot be as advantageously carried out with firms of British or allied nationality. The resolution passed on the subject by the Board of the Brighton Gas Company was quoted at the meeting; and its exact terms are reproduced in our report of the proceedings. The resolution may prove of assistance to others who are desirous of adopting a similar policy.

A More Drastic Lighting Order.

Up to the winter of 1913-14, local authorities had been progressively increasing the amount of light in the streets (not always wisely) in the declared interests of public safety. Since then they have, under orders that must be obeyed, been progressively bringing the amount of light in the streets at night time to almost, and in some cases to complete, vanishing-point, and attempting to wholly obliterate all beams of light from shop windows and private houses. Protection is found in extremes, but protection from different menaces—extra light being required for the defence of the pedestrian against the fast moving traffic in the streets (which traffic has now been opportunely diminished owing to the shortage of petrol), while the darkness is necessary for protection from the dastardly traffic above. Experience has proved that darkness is the most mystifying thing for the emissaries of one of the pieces of foul barbarism of which Germany has been guilty in this war. The proof of mystification has been the number of bombs that have dropped harmlessly into open fields and the sea; and, for the rest, no damage of military importance has been done, though the enemy has in "official" reports spoken of fortified places, munition works, military camps, harbours, docks, wharves, railway stations, and other places being bombed with excellent result. And the fooled German communities have rejoiced. The fact is a number of homes of poor people have been shattered, and unarmed men and helpless women and children have been murdered by the brutes. The nation the latter represent will be permanently stained by the blood of these victims. But the record shows that the successes in murdering and maiming innocent people are on the decline; and for this the protective plans—among which is dimming—are responsible. Therefore no one will complain of the more drastic lighting order that came into operation on Friday in the Metropolitan and City police districts, but which is no more severe than has been in operation for some time now in parts of the Provinces. On the whole, local authorities, shopkeepers, and householders have faithfully complied with the regulations; and there have been (seeing the many millions of people involved in complying with the orders made) comparatively few convictions of shopkeepers and householders for disobedience. There are threats of a Zeppelin campaign on a larger scale this winter; and no one, except those without the sense of responsibility, will do other than their best share in the protection, by the simple means advised, not only of themselves but their neighbours and of life and property generally. The new order will be, with few (if any) exceptions, cheerfully obeyed.

The Fuel Economy Committee and Gas Power.

Some people have an unhappy knack of going to work the the wrong way; and through it of not realizing their desired ends. The Fuel Economy Committee of the British Association are blameworthy in respect of a course of action which is not likely to gain for them all the information they require as to the extent to which different power agents are employed in industry. Many gas engineers have probably received circular-letters from electrical engineers, asking for information as to the number and approximate brake horse power of the gas-engines used in their districts of supply. This inquiry seems to have arisen through the Fuel Economy Committee having requested the Incorporated Municipal Electrical Association to ask their members to furnish certain particulars to them respecting their electric supply undertakings. So far so good. But these particulars, it is suggested, shall include data as to the estimated power employed in factories within the area of supply, and not only electric power (this is where the absurdity comes in), but power derived by steam, gas, and oil. Now, why on earth has the Fuel Economy Committee taken such a peculiar course as to seek information, through an electrical source, as to the number of gas-engines in use? The quarter in which to apply for such information is, through the Institution of Gas Engineers (who have a representative upon the Fuel Economy Committee), the gas undertaking of each city and town. It is surely peculiar that the Municipal Electrical Association should have been selected for this work, seeing that, as the title of the organization indicates, their membership does not cover the company electrical supply undertakings of the country. We must protest against the Fuel Economy Committee bye-passing the gas industry, and going such an extraordinarily roundabout way as to apply for particulars concerning the gas power business to one of the industry's competitors. It is all very well to say that the information will be treated as "private and confidential." But one cannot help feeling that an electrical engineer could not fail to be interested in the detailed intelligence as to the amount of gas power in his area of supply, which gas power he would very much like to supplant. He would be more than human if he were not so interested. We do not want to stand in the way of the Committee getting any information that is necessary to their work. But there has been more than sufficient ignoring of the gas industry in the past by the Government and other public bodies and institutions; and it is time a firm stand was made against the continuance of such procedure. It is therefore hoped that the information as to gas-engines will be withheld, until the Fuel Economy Committee have the courtesy to apply for it through the proper channel.

Scientific Research in Relation to Industry.

Eminently disappointing are the first annual reports of the Privy Council Committee and the Advisory Committee appointed to carry out a scheme initiated last year by the Government for the promotion of scientific research in relation to trade and industry. The reports do not tell us anything regarding the general subject that was not known before, and that has not been publicly paraded extensively in newspapers, periodicals, presidential addresses, and papers almost innumerable. We know of the laxity and the mistakes of the past; we know the problems involved in comprehensively organizing scientific research in connection with trade and industry are manifold and complex, and that many difficulties have to be overcome to put this country in the position to compete successfully with the most highly organized of its rivals. Well aware, too, are we that co-operation in research is a need that has been advocated time and again. It had been hoped that these Committees would have avoided in their reports the commonplaces of the matters referred to them, and have given us something new and really constructive. The truth is that the Committees from whom much was expected have not as yet got far in attacking their work. Where the Advisory Committee do launch out into suggestion of a constructive nature, it is much on the old lines. It did not require such a Committee to tell us that the production of research workers has been below the need for putting this country, in certain of its industrial and trading spheres, on an equality with, or in supremacy over, enemy trade rivals. The supply, however, has been equal to the demand, so far as our manufacturers went, though admittedly not so far as the welfare of their businesses and future progress were concerned. The latter is the important thing; and so it is easy to agree with the Advisory Committee (as we have agreed with others who have previously said the same thing) that a largely increased supply of competent researchers is necessary.

Co-operation and Other Matters.

The Committee also suggest that co-operation between the whole of the constituent parts of the great national organism is essential—that is to say, from the Government, through the local authorities, universities, colleges, and scientific and professional institutions, to industries and individuals. But as to co-operation, it is idle and absurd to suppose that industrial firms will be prepared to exchange information with other firms; and we say this notwithstanding community of interests. Why should one firm with brains, ability, and enterprise communicate anything to any other firm less efficiently equipped in these directions? The support by firms of co-operative research is understandable; but altruism in industry has not reached the heights when the good things resulting from individual research will be distributed with the freedom suggested by the Committee. The idea of compiling a register of researches is good; but firms are not likely to supply for such a register (unless the matter is to be confidential) information as to the lines on which they are working, so as to put others on the track. The establishment of an imperial "clearing-house" of information as to research ought to be a national advantage, if workable; but the Committee get out of their depth when dealing with the community of interests between employers and employed. Reference is made to the fact that some firms have striven to raise the standard of life among the workers, and given them a direct interest in the firm's success. But it is pointed out that small firms find it as difficult to provide pensions or clubs as to pay for research. Then follows the impracticable suggestion that some form of combination for *both* purposes may be found

to be essential if the smaller undertakings are to compete effectively with the great trusts and combines of Germany and America. The proposal so far as research goes is all right; but the idea of combination for pensions or clubs is rather ludicrous. The State has already shown by example—by the old-age pension, national insurance, and unemployment schemes—the difficulties of projects of the kind. It is also seen that the Committee have appointed standing Sub-Committees; that they have not been at all prodigal with their funds—the inclination being rather the other way; and that they include in their report remarks as to key or pivotal industries that have been said equally well before.

America and German Dyes.

The German dye and colour makers are doubtless keeping themselves well posted, through neutral agencies, as to what is going on in the outer world that will affect after the war the bountiful prosperity that was theirs before the despotic acts of Germany plunged Europe into devastating hostilities. Part of the devastation will be accomplished in the German dye industry. Last week it was seen how this country and France had entered into a friendly alliance which will assist in the developing and support of those plans which will, with time and investigation, relieve them of all need for assistance by outside dye makers. The markets of France and Great Britain will not only be largely closed against Germany, but Germany will, as time passes, have to meet in other countries with the competition of the Allies. The same in America. That country is getting along very well now with its own dye productions; and not only so but the makers are hoping to become sufficiently strong to resist the competition of Germany in future. The condition of things in that country is shown by the fact that, though the submarine "Deutschland," report says, succeeded in carrying about 125 tons of dyestuffs to America, users in that country are not in a position that compels them to buy at the exorbitant prices asked. They are simply ridiculing the prices, and rejecting the offers. The German dye makers have unquestionably been informed of this; and it will not diminish the uneasiness which the intelligence of the operations in England and France has caused them.

Public Works Loan Board.

The effect of the Treasury restrictions upon capital expenditure and borrowings by local authorities and others is shown in the forty-first annual report of the Public Works Loan Board, for the year 1915-16, which has just been issued. During the period referred to, loans have—in view of the need of preserving the capital resources of the country—only been granted by the Board where it could be shown that their purpose was urgently necessary in the national interest for the furtherance of the war, or for reasons of public health. Thus, the new loans granted during the year amounted to £1,152,716, which compares with £4,973,855 for the preceding twelve months; and of this sum no less than £554,328 represents loans for providing dwellings for munition workers, which leaves only £598,388 for other purposes. Most of this small balance represents unavoidable expenditure incurred in respect of contracts entered into before the war. The rates of interest on the Board's loans have been revised by the Treasury, and now range from 5 to 5¾ per cent. for different purposes under varying conditions. Of the outstanding balances of loans last March, 31½ per cent. carries interest at less than 3½ per cent., as against a proportion of close upon 47 per cent. five years ago.

CALORIFIC STANDARD ACT APPLICATIONS.

Official List.

We are informed by the Board of Trade that applications for Orders under the Gas (Standard of Calorific Power) Act, 1916, have actually been received by them from the following Companies. In all cases the calorific power proposed is 500 B.Th.U.

Cheltenham Gas Light and Coke Company.
Exeter Gas Light and Coke Company.
Harrogate Gas Company.
Ilford Gas Company.
Lea Bridge District Gas Company.
Northampton Gas Light Company.
St. Albans Gas Company.
Scarborough Gas Company.
Sheffield United Gas Light Company.
Shrewsbury Gas Light Company.
Stirling Gas Light Company.
Wellingborough Gas Light Company, Limited.

PERSONAL.

Further honour has been bestowed upon Mr. John Webster, the Assistant Water Engineer of Bradford. In recognition of his fifty years' service to the Corporation, the members of the Water Committee have presented him with a purse of gold and an illuminated address.

In the list in the "London Gazette" of officers upon whom the King has been pleased to confer the Military Cross, in recognition of gallantry and devotion to duty in the field, appears the name of Captain C. Colson, R.G.A. As forward observation officer, he displayed on three occasions an utter disregard of danger under heavy shell fire. His reports enabled his battery to be fought with great success. Captain Colson is the son of the late Mr. Alfred Colson, Engineer and Manager of the Leicester Corporation Gas Department. He chose the Army as a profession, and was in India when war broke out.

OBITUARY.

The death recently occurred, in his 68th year, of Mr. R. M. Sutherland, the principal of the firm of Messrs. James Ross and Co., of the Limewharf Chemical Works, Falkirk, and the Philpstown Oil-Works, Linlithgow. He entered the service of the firm as a boy, and quickly rose to a position of responsibility, becoming ultimately the chief partner. Falkirk and district enjoyed frequent proofs of his generous nature.

GAS ACTS FOR 1916.

[Second Article.]

We conclude to-day our review of the Gas Acts for 1916, but, as in the first article, only call attention to the changes that have been made since the Bills were lodged.

The Hornsey Gas Company by their Bill sought to have defined the limits of their supply area, and those of the Gas Light and Coke Company touching their boundaries. The latter Company were supplying within a portion of Hornsey; and the Hornsey Company sought to purchase from them their mains, pipes, and works situated within these parts. It is seen by the Act that the defining clauses have been much simplified. There is no mention in them of purchase; but the division of territory appears to have been accomplished by a give-and-take process. The Company also sought powers to manufacture residuals on certain lands; but at the end of the clause there now appears the liberty restricting words "by them." The calorific standard clauses have been inserted on the lines of the Model Bill ones. The standard is 540 B.Th.U., with 7½ per cent. margin before the penalty line is reached. The provisions as to special purpose fund, benefit fund, the transfer of £25,000 from revenue to capital (but not entitled to dividend), and the making of grants to employees injured and dependants of employees killed in the war, are as mentioned in the notice of the Bill. A considerable number of modern ordinary clauses are embraced in the measure. The Hornsey Corporation have secured certain protective provisions which are unusual. They are as follows:

In the exercise of the powers conferred upon the Company by the section of this Act, the marginal note whereof is "Manufacture of Residuals," the Company shall from time to time adopt and use none but the most approved processes and methods of manufacturing, working-up, and converting residual products, and shall carry on the same so as not to cause any nuisance or annoyance to the residents in the neighbourhood.

The Company shall not, without the consent of the Corporation, cause or allow any effluent arising in the working-up, manufacture, or conversion of residual products to pass directly or indirectly into any part of the River Moselle which is within the Borough of Hornsey (in this section called "the borough") nor into any storm-water outfall, culvert, or sewer within the borough, or into any drain connecting with such storm-water outfall, culvert, or sewer. If the Company commit a breach of any of the provisions of this sub-section, they shall be liable to a penalty of £50 and to a further penalty of £5 for every day during which such breach shall continue.

The price to be charged by the Company to the Corporation for gas supplied to public lamps in the borough for a period of ten years from the passing of this Act shall be the net cost of manufacture.

The Company before supplying gas to any public lamps in the borough which are now supplied by the Gas Light Company shall, at their own expense, make all alterations thereto, and in any fittings thereof, which may be necessary to adapt such lamps and fittings for the supply of gas thereto by the Company. All works which it may be necessary to execute in any street within the borough for the purpose of connecting such lamps with the mains, pipes, and works of the Company, or for disconnecting such lamps from the mains, pipes, and works of the Gas Light Company, shall be executed at such points as shall be agreed between the Corporation and the Company, or as, in default of agreement, may be determined by arbitration, so as to avoid any undue interference with the streets in the borough, and all such works shall be executed in accordance with, and subject to the provisions of, the Gas-Works Clauses Act, 1847,

with respect to the breaking-up of streets for the purpose of laying pipes.

If any difference shall arise between the Company and the Corporation touching this section, or anything to be done thereunder, such difference shall be settled by an engineer as arbitrator agreed upon between the parties, or, failing agreement, to be appointed by the President of the Institution of Civil Engineers on the application of either party.

The Wood Green District Council and the Tottenham and Wood Green Joint Drainage Committee and the Tottenham District Council have secured clauses protecting them from the discharge, directly or indirectly, of noxious matter into drains, sewers, streams, or water courses, and providing for penalties in the case of any infraction. [*Parliamentary Agents: Messrs. Sherwood and Co.*]

The Imperial Continental Gas Association have secured their Act, which confers upon them extended powers, primarily among them being authority to purchase, take on lease, hire, hold, use, and manage any undertaking for the supply to any cities, towns, places, or persons in any foreign country, or in any part of His Majesty's overseas dominions, of gas or electrical energy (whether for lighting, heating, or power purposes), or of any other means of producing light, heat, or power already known, or hereafter to be discovered. The further powers in this connection cover about one-and-a-half pages of the Act. Then there is a clause confirming the distribution of funds to the proprietors since the war started, in accordance with the terms of resolutions passed at two meetings. Authorization is also given as to the issue of stock at a discount. The next clause confirms the condition as to redemption upon which the existing debenture stock of the Association was issued, and the purchases of such debenture stock by the Association in pursuance of that condition. It also empowers the redemption of the whole or part of the debenture stock, either by paying it off at £105 per cent. or giving six months' notice to the holders, or by issuing, subject to the consent of the holders, other debenture stock in substitution. Provision is made for the formation of a redemption fund. The Association are not to reduce their nominal capital as provided by section 8 of their Act of 1878, unless, simultaneously with such reduction, they redeem any then outstanding debenture stock equal to one-fourth of the nominal amount by which the capital is reduced. Under another section, it will suffice if the Association now hold one ordinary meeting a year. Other clauses refer to the number of Directors and their qualifications. [*Parliamentary Agents: Messrs. Dyson and Co.*]

The Newcastle-on-Tyne and Gateshead Gas Company have secured the extension of their limits of supply in the counties of Northumberland and Durham, with the proviso that they are not to at any time supply gas beyond the existing limits of supply if this would interfere with the sufficiency or efficiency of the supply of gas which they are for the time being bound to provide within the City of Newcastle and the County Borough of Gateshead. The laying of all mains and pipes before the passing of the Act for the purpose of supplying gas within any part of the specified areas is to be deemed to have been done under the powers of the present Act. Confirmation is given to an agreement with the Birtley Iron Company. This provides that, upon the expiration of twelve months after the war terminates, the Company shall lay down mains to supply gas to the Birtley Company's holders. The gas is only to be delivered between midnight and sunset, and then only at a rate not exceeding 25,000 cubic feet per hour. The holders into which the gas is to be delivered shall be so constructed and maintained as to be fully lifted by a pressure of gas not exceeding 5 inches. During the twelve months following the completion of the main, the Iron Company are not to take or to pay for less than 15 million cubic feet of gas. Thereafter, during the continuance of the agreement, they are not to use, distribute, or supply any gas other than that supplied by the Gas Company, nor are they to distribute or supply any electric current, provided that nothing in the clause is to prevent the Iron Company from using any gas produced at any coke-ovens belonging to them for the purpose of generating electric current for use by them for any purpose in or about their collieries, railways, or works, but not for sale. During the continuance of the agreement, the Gas Company are not to supply gas in Birtley Ouston and Urpeth without the written consent of the Iron Company, excepting that (within a specified area) they may supply gas to any works or factories and dwelling-houses connected therewith, the supply of which is taken through the meters of the works and factories, and paid for by the owners and occupiers thereof. The Iron Company are at all times, during the existence of the agreement, to use their best endeavours to promote the sale of gas within the parishes by satisfying as far as they reasonably can, and on reasonable conditions, the requirements of all persons taking or requiring a supply of gas. The agreement is to continue for thirty years; but it is determinable by the Iron Company at any time after the first five years on twelve months' notice. If the agreement is determined, the Iron Company are to pay the Gas Company the amount of the original capital cost incurred in laying the main, subject to a deduction of 3⅓ per cent. for every completed year under the agreement. Accounts for the gas are to be rendered at the ordinary price; but if the quarterly accounts are paid within twenty-one days after delivery, they are to be entitled to a discount of 25 per cent. from the gross price. Attached to the new gas-works clause are the usual residuals clauses. The one-third purchase restriction is now included; but it is only to apply "after the termination of the present war." The calorific value standard (500 B.Th.U. total heat test) is substituted for the illuminating power one. Provision is made for additional testing-places in Newcastle and Gateshead, upon the Corporations providing in specified buildings accommodation for the necessary apparatus. The minimum pressure of gas is put at 15-10ths. In its operation in the City of Newcastle, section 37 of the Company's Act of 1896, is, from Dec. 31 last, to have effect:

Provided that in any year in which—

(*a*) The Corporation of the City of Newcastle-upon-Tyne shall require all the public gas-lamps in that city (other than lamps discontinued under the provisions of this section) to be lighted on some part of every day of such year; and

(*b*) The average number of hours for which the lamps that are lighted and extinguished by mechanical means are lighted is not less than 3000 hours per lamp, and the average number of hours for which all other lamps are lighted is not less than 3776 hours per lamp;

there shall be allowed to the said Corporation an additional discount of 2½ per centum.

Protecting clauses in regard to the laying of mains and pipes are given to the Durham County Council and the North-Eastern Railway Company. The Company are empowered to purchase gas from any other companies, bodies, or persons under the provision as to the sale of gas by contract. The Company are not to give any preferential price as between any consumers who shall take a supply of gas from the Company for similar purposes in similar quantities and under similar conditions and circumstances. The Company will not in future be bound to the nominal value of their stock as the minimum for a reserve price:

Notwithstanding anything contained in section 19 (New Stock to be Offered by Auction or Tender) of the Act of 1901, it shall be lawful for the Company, for the purpose of any sale by auction or tender of any stock created under that Act or this Act, to fix such reserve price as they may think fit, and so much of the said section as provides that the reserve price put upon the stock referred to in that section for the purpose of sale by auction or tender shall not be less than the nominal amount thereof shall be, and the same is hereby, repealed.

In respect of preference capital, the words "seven pounds" are to be deemed to have been inserted in section 15 (as to dividend on new preference capital) of the Act of 1901, instead of the words "four pounds." But this change is only to apply to preference stock created after the passing of the Act. The rate of interest on debenture stock is not to exceed 5 per cent. Power is given to issue redeemable preference stock; but a redemption fund is not allowed—redemption being by the means already described in connection with other Acts. Then, in addition to the amount which the Company are by their recited Acts authorized to raise by the creation and issue of debenture stock, they may raise, in the form of such stock, any sum or sums not exceeding in the whole £320,000. Any stock created under this section is to be issued as redeemable debenture stock—redemption to be by paying-off or by issuing to the holder, subject to his consent, other redeemable debenture stock. For the purpose of providing money for paying off the redeemable debenture stock, or of providing substituted stock, the Company may create and issue new redeemable debenture stock, or reissue, under the same or altered conditions, redeemable debenture stock created under this section.

At the expiration of twenty-five years from the date of the first issue of any redeemable debenture stock under the preceding provisions of this section, the powers of the Company to issue redeemable debenture stock under the said provisions shall cease, and the redeemable debenture stock issued under the said provisions, and then outstanding, shall be redeemed, and shall not be reissued.

For the purpose of enabling the Company to provide any moneys required for permanently paying off such redeemable debenture stock, the Company may raise such sum or sums as may be necessary by the creation and issue of new ordinary stock or new preference stock, or partly in one way and partly in the other, and by the creation and issue of debenture stock.

It is expressly provided that the Statutory Companies (Redeemable Stock) Act, 1915, shall not apply to the Company. [*Parliamentary Agents: Messrs. Dyson and Co.*]

The Plymouth and Stonehouse Gas Company's Act is an important one, seeing that it confers powers to acquire and carry on the property and business of Thomas Henry Harvey deceased, relating to tar distillation and the conversion and utilization of gas residual products. In conjunction with this purchase, the Company may enter into agreements to purchase tar from producers in Devon and Cornwall; and from any other company, local authority, body, or person, any residual products (other than tar) arising from the manufacture of gas. The calorific power clauses, the provision as to the issue of debenture stock as consideration for the acquisition of the tar distillation and residuals manufacturing property from the executors of the late Mr. Harvey, the power to create additional debenture stock up to the sum of £30,000, and the authority to issue debenture stock as redeemable are all as when the Bill was introduced.

In the event of any redeemable debenture stock issued under this section being conditioned for redemption by payment, or by part payment in cash of the redemption price thereof, the Directors of the Company may from time to time, but so as not to affect the priority of interest on any mortgages, bonds, and debenture stock of the Company, or other fixed charges and obligations, set apart out of the revenue derived from the business of tar distillation such sums as they may consider proper for the purpose

of forming a fund for the redemption at maturity of such redeemable debenture stock. Provided that no such sums shall be set aside so as to reduce below £4000 the amount carried in any year ending on the 31st day of March to the credit of the revenue account in respect of the sale or distillation of tar.

There are no other provisions calling for notice. [*Parliamentary Agents: Messrs. Dyson and Co.*]

There are a few changes from the Bill [see Dec. 28, p. 712, and Jan. 18, p. 133] in the South Metropolitan Company's Act. The principal are: The proposed additional capital of £1,000,000 has been reduced to £250,000. The suggested power to borrow on mortgage has also undergone some little alteration. The Company are now authorized to borrow on mortgage any sum or sums not exceeding in the whole £100,000; and of this they may borrow any sum not exceeding in the whole £20,000 in respect of each £50,000 of the additional capital which they are authorized to raise; but no part of the £20,000 is to be borrowed so long as there is outstanding a sum of more than £400,000 under the powers conferred by the section "Power to Raise Money Temporarily on Mortgage or by Debenture Stock." By this section, authorization is given to the raising of £500,000 either by borrowing on mortgage or bond, or by the creation and issue of debentures or debenture stock. But this sum of £500,000 is to be reduced by the amount of any sums raised under the previously mentioned power to borrow on mortgage, or by the creation and issue of debenture stock. Redemption of this temporarily raised money is to be effected within seven years; and

The Company may, if they think fit, apply in or towards the repayment of moneys borrowed on mortgage or bond under the powers of this section or the redemption of debentures or debenture stock created and issued under the said powers, the whole or any part of any moneys raised by borrowing under the powers of the section of this Act of which the marginal note is "Power to Borrow on Mortgage," or by the creation and issue of debenture stock in respect of such last-mentioned borrowing powers, and if and so far as such re-payment or redemption shall not be effected by means of moneys so raised, the Company shall apply in or towards such repayment or redemption any other funds in their hands available for the purpose.

Then powers follow as to the issue of redeemable preference and debenture stocks. No redemption fund is allowed; but

It shall be lawful for the Directors of the Company from time to time to issue—

(*a*) New stock, whether ordinary or preference (and as regards any preference stock whether redeemable or otherwise), to such amount as may be necessary to provide money for the redemption or purchase of any redeemable preference stock; or

(*b*) New debenture stock, whether redeemable or otherwise, to such amount as may be necessary to provide money for the redemption or purchase of any redeemable debenture stock;

or to issue any such new ordinary or preference stock or new debenture stock for the purpose of redemption of, or in substitution for, any such redeemable preference stock or redeemable debenture stock (as the case may be).

These are the only points that need notice. [*Parliamentary Agents: Messrs. Dyson and Co.*]

The Uxbridge Gas Company have obtained their Act, empowering them to purchase the Eton Gas Company's undertaking on the terms set forth in the "JOURNAL" for Jan. 18 last (p. 134), and to extend their limits of supply to include Eton and a number of parishes. The provision as to excess charge in the added limits has been altered somewhat. In the new territory, for a period of five years after the date of transfer, a sum of 6d., and thereafter 4d. per 1000 cubic feet, may be charged in excess of the price from time to time charged for gas supplied within the limits of supply as existing immediately before the passing of the Act. All the other clauses are in effect as when the Bill was noticed. But there has been inserted a clause which provides that no building (other than gasholders or other works or buildings for use in connection with a gas-works undertaking) shall be erected on lands described in the third schedule of the Act, or on any part of such lands, unless the consent in writing of the Eton College authorities is first obtained. In reference to the same land, protection is given to Windsor Castle. A belt of poplar or other trees approved by the Commissioners of Works is to be planted and maintained along or near the south-easterly boundary of the land for the purpose of providing a screen to render the gasholders and other works of the Company on the land as inconspicuous as possible. No gasholder or other works for the storage of gas to be erected on the land is at any time to exceed 40 feet in height above the surface of the ground. No building exceeding a height of 50 feet is to be erected without the consent of the Commissioners. No buildings erected on the land are to be used for any manufacture or for works not by the Act expressly authorized which, in the opinion of the Commissioners, are likely to become noisy or offensive, or otherwise prejudicial to the amenities of Windsor Castle. [*Parliamentary Agents: Messrs. Lees and Co.*]

The "Board of Trade Journal" announces that a Genoa representative would take up the agency of United Kingdom manufacturers of gas-stoves. Inquiries should be addressed to the Secretary, British Chamber of Commerce for Italy, No. 7, Via Carlo Felice, Genoa—quoting No. 1106.

GAS-WORKS AND BENZOL EXTRACTION.

MUCH concern has been expressed as to the desirability of the extraction of benzol, toluol, &c., from town gas during the war; and the question has already been raised as to the advisability, and the possibility, of its continuance after the war. There is a wide diversity of opinion as to what is the best course to adopt. There are two schools of thought, both of which can bring forward strong arguments to support their cases. On the one hand, we have those who say that it is impossible to judge what the conditions are likely to be when the war is ended; and to commit oneself to a policy in the dark is not wise. This we might term the "wait and see" policy. On the other hand, there are those who say that the position is quite clear, and that gas-works should have no hesitation, and should immediately declare for the continuance of benzol extraction, because there is almost the certainty that the demand will increase rather than decrease.

Many factors have, of course, to be considered in a question of this kind; and the side-issues are so numerous, and the circumstances in different cases so entirely different, that one is loth to lay down a hard-and-fast line to be followed. On the whole, one is inclined to recommend the policy of recovering as much as possible from the coal; and in this case it would mean recovery of benzol. But how are the public going to view the matter? We immediately run up against the complaint of decreased value for money to the gas consumer.

We have already seen how certain interests have attempted to oppose the idea unless a corresponding reduction in price was made to the gas consumer. They put forward the reason that, prior to the extraction of the benzol, &c., the consumer was paying a certain price for a certain article—coal gas, to wit. Through certain circumstances, something which had previously been an integral part of the gas which was sold was removed from it. It must follow, therefore, that the new article was inferior, and therefore a less price must be paid it. They seem to forget that the gas is bought per cubic foot, and that, although something is taken out, they still get a cubic foot of gas, which for almost all practical purposes makes no difference. Still, the argument is there; and it has got a good hold on the public. In many districts naphthalene troubles have been very rife since the extraction of toluol began; and when complaints have been made, the public have very frequently been informed that the trouble was entirely due to the fact that the toluol was being extracted to help the Government and to win the war. In most cases the consumer went away satisfied in his own mind that he was a patriot in putting up with it. But patriotism of this kind rapidly begins to wane if occasionally the working man has to go without his dinner, or with a badly cooked dinner, because the gas supply is inefficient on account of a naphthalene stoppage. Then the gas consumer begins to think he ought to have some compensation, and he joins in the cry for a reduction in the price of gas. The only remedy against this is the education of the consumer; and we have to bring home to him the real meaning of calorific value, and show him that he is getting value for money in heat units.

The adoption of a calorific value standard in place of an illuminating power standard hardly appeals to the average consumer, because it is something which he does not understand. There are in most working-class houses one or more flat-flame gas-burners—particularly in bedrooms. The consumer soon notices a difference in illuminating power, because it makes such a direct appeal to his senses. He would not detect a like proportional difference in calorific value, because the ordinary consumer does not realize the fact that a cubic foot of gas means so many heat units.

If then benzol is to be extracted, some substitute must be used and the gas enriched by other means. This we know can be easily done by means of heavy oils, which brings us to another aspect of the question. Those who believe in the "wait and see" policy will be faced with the whole matter again when the war is over. In the meantime, they are putting up, in hole-and-corner fashion, any sort of crude plant for war time extraction. Inefficiency and confusion are inevitable results. Some are content with the "C" process, and give no satisfaction to their consumers. Their reply to complaints is that it is all due to the war, and everything will come right in time. Then, after the war, they still have a decision to make. If they decide to continue extraction, then efficient plant is required, and also much additional work, to produce such a gas as will satisfy the consumers now that the "war time" excuse is no longer available. If, on the other hand, the decision to continue benzol extraction is made now, an efficient and well-designed plant can be put up in the first instance. While the consumers are in a tolerant mood—on account of the help which is being rendered to the country—the arrangements for producing a satisfactory gas can be perfected and all parties be satisfied. The motoring fraternity are doing all they can in the interests of benzol, and, as a motor spirit, it can now be produced in entirely satisfactory quality. Then the development of the British dyestuff industry will more than account for any surplus over motoring requirements. The question is an important one; and it would be interesting to have the views of readers upon it.

The autumn meeting of the Iron and Steel Institute will be held at the Institution of Civil Engineers, Great George Street, S.W., on Thursday and Friday, Sept. 21 and 22, when eight papers are expected to be submitted for reading and discussion.

ELECTRICITY SUPPLY MEMORANDA.

JUST before the war started, the electric industry was considering the new schemes which had issued from various quarters, and were designed to co-ordinate, and so bring about, better and (so it was thought by some, and contested by others) cheaper electric supply conditions for London. Plans included large generating plant concentration upon the River Thames. Then hostilities burst upon the world. In due season there was bombardment of "unfortified towns" up North, and Zeppelins paid visits to the country. Then generating works concentration was considered in connection with the new military conditions; and it was thought that it would not be particularly safe to give London and its environs over to electricity supply from even two or three large stations, when from aloft these would be particularly vulnerable, and untold mischief might result from a well-directed bomb or two on each station. A Zeppelin has emphasized this view; and probably when generating plant concentration for London is again talked about in the Parliamentary Committee Rooms or elsewhere, the incident will not be overlooked. In one of the official reports regarding the raid of last Thursday week, it was mentioned that "an electric power station was slightly damaged." As some of the German gas engineers may not see the British official report, but may have an opportunity of reading this note, it may be mentioned for their information that the cowardly murderers who travelled on their nefarious mission thousands of feet up in the air—preferring the safety of height to honest warfare—succeeded in killing three men, three women, and three children, seriously injuring three men and four women, and slightly injuring four men, seven women, and three children. They are no doubt proud of their achievement in killing unarmed men and helpless women and babies; and probably they will get iron crosses from the Kaiser for what they did. We hope there are no German gas engineers who are proud of this cold-blooded murder of civilians, or of the high-placed military authorities whose tools the murderers are.

The Emphasis of a Zeppelin.

Gas Helps the Electrical Industry.

The other day, it was seen that "Meteor" of the "Electrical Times" graciously conceded that the gas industry would be allowed by the electricity industry to continue its existence in a limited sort of way for the supply of gas for industrial purposes. Of course, we are all grateful to him for this consideration. Possibly there was a little selfishness about the concession; "Meteor" probably being aware that gas has its economic part in the production of the machinery, cables, and bulb lamps needed by the electrical industry. Therefore, the gratitude ought to come from our competitors, and not from us. In the paper that Mr. Ralph Halkett was reading last week before the North British Association of Gas Managers, he showed how, by the use of gas in connection with a lead press employed in the covering of electric cables of various diameters, considerable economy is effected, through the savings in time, fuel, labour, and floor space, combined with which are convenience, cleanliness, reliability, and constant fuel value. In many other ways gas helps our competitor; and some of these ways were alluded to in the paper which Mr. H. M. Thornton read before the Royal Society of Arts in March, 1915. He mentioned, for instance, the sealing of electric-lamp bulbs by gas and air-blast blow-pipes. Another electrical firm he knows about consumes gas freely for gas-fed soldering-irons used in the manufacture of armatures. We know of an electrical firm in the Midlands whose consumption of gas runs into many million cubic feet per annum. In fact, as Mr. Thornton said in his paper, "from the generation of electricity to its use, our electrical friends have recourse to the excellent thermal properties of their competitor's commodity."

Growing Unimportance of Lighting Load.

It was recently remarked in the "Memoranda" that, if the lamp to which has been applied the pseudonym of "half-watt" reaches the lower sized units that can be applied to domestic use, certain conditions would be brought about that would make the domestic lighting load less attractive than now to many undertakings, and that some of them would soon be in a state of insolvency. Several of them would have been in this state long since, had it not been that, being local authority concerns, they came pauper-like upon the rates for their maintenance. Mr. Lofthouse, of Harrogate, is of opinion that the undertaking depending entirely on lighting, is going to be in a parlous condition. He expressed this opinion when recently moving the adoption of the minutes of the Electric Supply Committee at the meeting of the Town Council; and these were the words he used: "Electricity for lighting purposes is fast becoming so cheap, owing to improvements in lamps, that an undertaking for supplying electricity for lighting alone would not pay." This is definite; and those responsible for undertakings so conditioned are beginning to feel that there is a considerable amount of truth in what Mr. Lofthouse says. Under the circumstances, there is gratification, from his point of view, that electricity is being used more freely in Harrogate than formerly for purposes other than lighting. Even "Meteor" of the "Electrical Times" has realized how "unimportant the lighting constituent is becoming" to an electricity station. He illustrates his point thus: "At Keighley the number of kelvins sold for private lighting has only increased by 168,000 in ten years. In the same time the power demand has increased by 5,940,149 kelvins. For private lighting in 1915-16, Keighley sold 280,518 kelvins; and for power, 6,046,366. Result, a record gross profit of £8689. Now let us turn to Coventry. It made a gross profit of £45,311, and a net profit of £18,000. But this was not due to high-priced units, since no less than 97 per cent. of the energy was used for power purposes. Some 3 per cent. only may be allotted to shops and houses combined. If every private house in Coventry changed over to rushlights to-morrow, the effect would not be calamitous. As for daylight saving, its effects should be altogether negligible." The long-hour power load with units charged at lower rates than for lighting is a greater factor in the prosperity of an electricity station than the short-hour heavy-priced lighting units.

House of Lords and Overhead Wires.

Those electricians who are anxious for more leniency being shown in the matter of carrying electrical cables through rural territory upon poles—notwithstanding the uncomfortable experiences when gales and storms have interfered with their stability, and brought them to earth, to the physical discomfort of anyone who is unfortunate enough to come into contact with them, will not be pleased over a recent happening in the House of Lords, as it rather assists to shatter their hopes of obtaining cheaper transmission by overhead means at the expense of safety and local amenities. The Telegraph (Construction) Bill was under consideration, when the question of the depreciation of the amenities and value of land by telegraph poles was raised. It was considered by some of the noble lords, who are probably landowners, that the County Court Judges who are the tribunals to take into account the public interests should, if deemed necessary, order lines to be carried underground. The Government, in the interests of the Post Office, resisted; but, in the result, an amendment was inserted in the Bill which specifically mentions the carrying of lines underground as a stipulation the tribunal may make. If there is to exist this right of stipulating underground construction in the case of Government telegraphs, the chances are rather remote of the electricity industry obtaining statutory authority to depreciate the value and the amenities of the land in rural districts.

Confessions in Water Heating.

Those who know anything of the swiftness with which hot water can be economically obtained by the aid of gas will be interested in reading the confessions that occur in an article in the "Electrical World" advocating electricity as a means of providing a supply of hot water. Tank-heaters (the article says) are generally installed in outside piping, so that the ordinary range boiler may be used. Obviously both the tank and as much of the hot-water piping as possible should be well heat-insulated, in order to cut down radiation losses to a minimum. A further "kink" is to place a diaphragm in the piping, in order to restrict the free circulation of water from the heater, which otherwise would be quite rapid. Without restricted circulation, a large amount of water is heated a few degrees only; and after a large quantity of hot water has been drawn off from the tank, it is a matter of hours with a small-sized heater before the water again reaches a high temperature. But if, with a medium-sized heater of from 750 to 1000 watts, a diaphragm of copper leaf with a hole about $\frac{1}{4}$ inch in diameter is inserted in a navy union near the top of the tank, the circulation can be so restricted that water near the boiling temperature will accumulate at the top, and a small amount will be available within a short time after all the hot water has been drawn off. Domestic efficiency is not going to be promoted under such circumstances.

Wattage and Candle Power.

The much-discussed subject of rating incandescent lamps—as to whether they should be rated and marked in watts or candle power, or both (we favour both)—has had fresh contribution made to it by R. Naujokz in the "Elektrotechnische Zeitschrift;" and he gives various cogent reasons against the preference of some manufacturers to hide the deficiencies of their lamps by stating only the wattage. Mention of both wattage and candle power is something of a guarantee that for a specified wattage a certain candle power will be realized; and the makers are fully aware that there are wide divergencies between the candle power of the different firms' lamps marked with the same wattage, as well as between lamps of their own make. They argue that ordinary users do not know anything at all about candle powers—horizontal or spherical; and that it is easier for them to discriminate between lamps by the current taken. But consumers know when they buy a 32-candle power lamp, they are not going to get the same light from it as from one described as of 50-candle power. And observant consumers do soon get to know by experience whether they have a decent (say) 32-candle power electric lamp or a bad one. But what is the good of merely quoting the wattage if it is found that lamps taking equal wattage differ sometimes by as much as 25 per cent. As Mr. Naujokz says: "The rating according to watts leads to many values being placed on the lighting capacity of a lamp, and just as a man has every right to know the output of a machine which he is proposing to buy, so he ought to be

provided with information as to the light which may be expected from a given lamp." In a table accompanying the article referred to, the author shows the variations in candle power from the testings of a number of lamps. Let us refer to three examples from the number. First to lamps taking 100 watts, and known as "A," "B," "C," and "D" (all the figures are not given for "C"), and for voltages of about 130. The mean spherical candle power of "A" was 130, of "B" 125, and of "D" 110—a difference of 20 candle power between the highest and lowest; while the maximum candle power figures were 160, 165, and 140. For lamps for voltages of about 250, the readings for "A," "B," "C," and "D" were: Mean spherical candle power, 110, 100, 95, and 95; and the maximum candle power, 140, 130, 107, and 125. Going next to 500-watt lamps, the variations of candle power are shown more markedly. For the lamps for 130 voltage, the mean spherical candle power for "A," "B," and "D" was: 880, 720, and 715; maximum candle power, 980, 950, and 925. For the 500-watt lamps for about 250 voltage, the mean spherical candle power was 800, 670, and 665; the maximum candle power, 880, 860, and 865. The mean spherical candle power in this instance exhibits some ugly variations. Then for 1000-watt lamps for about 130 voltages, the mean spherical power of the three lamps was 1820, 1500, and 1420—a difference of 400 candles between the top and bottom figures. The maximum candle power was 2040, 1900, and 1850. Then the 1000-watt lamps for about 250 voltage gave a mean spherical candle power of 1760, 1500, and 1420. The maximum candle power of the same lamps was 1960, 1900, and 1850. The maximum candle power shows a nearer equality than the mean spherical in the larger power lamps.

A GERMAN REVIEW OF THE INFLUENCE OF THE WAR ON THE GAS INDUSTRY.

THE following is a further instalment [see *ante*, p. 339] of the address which Herr M. HASE, of Lubeck, gave in his capacity of President of the German Association of Gas and Water Engineers, at the Berlin meeting on June 28.

INFERIOR COAL.

Complaints have been rife as to the bad quality of the coal supplied. Generally they arose through bad and dear coal being obtained from new sources to make good short supplies from the old collieries. But even the deliveries from the latter left much to be desired—free burning coal has been supplied as gas coal, and small coal as large coal. Often the coal was not properly picked over; it contained much ash and moisture, and was very prone to spontaneous ignition. It is no wonder that works found difficulty in handling the mixed supplies, for one works received deliveries from 22 pits in a single month. There is, however, now an improvement in this respect; and the works also have accustomed themselves to the new conditions. The working results, however, have suffered. The make of gas and the yield of coke have receded, the quality of the gas has been none too good, but that of the coke worse. The settings required more fuel, the coal either gave a small make or needed longer time for carbonization, coke was not available for heating the settings, and accumulations of thick tar and stopped ascension pipes multiplied. Exceptionally, however, there were works where things went on as usual.

BYE-PRODUCTS.

Generally speaking, the receipts from bye-products did not rise in proportion to the rise in the price of coal. This was a natural consequence of the enactments, often inexplicable, restricting free sale, imposing maximum prices, &c., and was the more surprising, since not merely the military authorities, but agriculture and the food supply of the country, stood to benefit greatly by the recovery of gas-works bye-products. Consider ammonia as a substitute for nitrate both as a fertilizer and a source of nitric acid for munition works; the value of tar products; of benzol for spirit for both motor vehicles and air-craft; of toluene for the explosives industry. The coke market was fickle. The coke was frequently dirty, small, soft, and full of ash; but nevertheless generally it could be readily disposed of.

LABOUR DIFFICULTIES.

The question of labour was almost greater than that of coal. Even on claims and exemptions alone, an enormous amount of trouble and time had to be expended. There was a lack of sturdy men for the retort-houses, of mechanics and fitters, and of foremen to supervise the new and untrained hands, who were mostly youths, old men, home-service and militia men, disabled soldiers, interned civilians, and prisoners of war, as well as some women. Foreigners became common—including Turks, Gypsies, Negroes, and Italians. Changes were frequent, as many proved useless, or the work did not suit them, while accidents and illness prevailed. The new hands, moreover, got through much less work than the old, so that a bigger staff and reserve were needed.

Prisoners of war have been frequently employed with, on the whole, tolerably good or passable results. There is, however, general agreement that prisoners of war cost more and do less than free workmen—the reduction in work accomplished reaching as much as 50 per cent. There is a proverb about the Russians that he who uses plenty of grease travels easily; and the author can testify from personal observation of the giant appetites of Russian prisoners that a very great deal of the "grease" which is now so costly is necessary to make the "cars" run well. It is self-evident that at the present time the place for every German fit for service is at the front; but on the other hand, it is reasonable that the military authorities should provide suitable substitutes, in order that the important work of the gas industry should be carried on. Actually they have recognized this responsibility by sending back men when it has been clearly shown that they were indispensable, by lending men reserved for garrison duty to take the place of men sent to the front, and by suggesting men who have been disabled in the war. The Prussian War Office replied to a petition (dated March 21 last) that the attention of District Commanders had been again drawn to the importance, for the prosecution of the war, of maintaining the work of the gas industry, and that they had been instructed that gas-works were to rank as regards reservation of labour with works which were directly concerned with the production of war material.

In regard to female labour, Herr Friedrich Lux, of Ludwigshafen, had celebrated in verse, in a Baden paper, the story of a Passau blacksmith, whose five sons, having been called up, had been replaced at the forge by his three sturdy daughters! Indeed German women had not been backward in fulfilling their duty to their country. In the office, the female element was predominant, and had generally given satisfaction. In works, opinions were divided. The work done is stated to be half to three-quarters of that of a man. Women have been employed more especially in reading meter indexes, renewing mantles, and for light gas-fitting work, in collecting accounts, emptying prepayment meter boxes; also as porters, attendants, and in purifier-houses, coke yards, and tending public lamps.

RELATIVE ADVANTAGES OF VARIOUS SETTINGS.

Obviously some types of settings have adapted themselves better than others to the altered conditions of coal supply and labour. Though great difficulties have not generally arisen, there is no question that many types of carbonizing plant and systems of working have proved disadvantageous for working-off unsuitable or poor coal. It was often impossible to get a sufficiency of powerful stokers for the manual charging of horizontal retorts, and much repair work was necessitated through charging scoops being operated by unaccustomed hands. The use of non-caking coals caused difficulty in expelling the slab of coke from oven carbonizers, through horizontal and vertical retorts; the coke packing solid and causing damage to the discharging machinery. In a few cases, 5 to 10 per cent. of lignite was added, or special mixtures of coal were made, in order to facilitate the discharge of the block of coke from vertical retorts. Inclined retorts have received the best reports; the use of poor coal does not appear to have caused any trouble with them.

War experiences have taught lessons in regard to types of settings of which managers will profit after the war. Many German coals are not suited for gasification in completely filled vessels. Preference generally must be given to the system of carbonization which, while entailing the least manual labour, has the minimum of machinery and takes advantage of gravity. It is universally recognized that ample reserve carbonizing plant is necessary, and that this reserve must always be maintained. Actually the existing reserve plant has now in many cases been partially or wholly brought into regular use, owing to the smaller yield of gas from the coal, the greater demand for gas, and the fact that the lower specific gravity and calorific power of the gas have increased the consumption. In rare instances only has the routine of the retort-house been changed. In a few cases longer shifts are now worked on Sundays. For the time being twelve-hour shifts have been resorted to in place of eight-hour, the carbonizing time has been extended, and heavier charges worked.

Those gas-works which draw their supplies from outside undertakings have naturally had the advantage of freedom from scarcity of coal and inside staff. Coke-oven works have invariably given the contracted-for supplies, apparently without difficulty. In the case of one town which took its gas partially from coke-ovens, the quantity thus obtained was considerably enlarged, in order to eke out the stock of coal on the gas-works. But as the coke-works stripped the gas of oil, and had to use less good coal, the calorific power of the gas supplied by them deteriorated, and the quality of the gas was not as uniform as formerly.

TEMPORARY PLANT AND FITTINGS.

The war has naturally necessitated certain extensions and modifications of gas-works plant, chiefly with a view to improving the products obtained. In this category may be mentioned plant for stripping the gas of oil, plant for producing concentrated gas liquor and sulphate of ammonia, tar distilling and benzol recovery plant, and briquetting installations. Very frequently such additions were, on account of urgency of requirements, of a purely provisional character, and not in accord with the general scheme for extending the works. Large extensions and reconstructions have naturally been postponed.

As regards substitutes, the chief instances of their use is the replacement of copper alloys by zinc and iron. Fault was found chiefly with the zinc alloys which were used for sockets, taps, screw-fittings, meter unions, cooker-fittings, and burners. The material was partly too brittle, partly too soft, and tore easily. Better results were obtained with iron—preferably soft cast or wrought iron, though iron taps easily became fixed, rusty, and leaky. Iron coated with white metal or bronzed has proved

serviceable for taps and fittings. Complaints have been greater as to burners, especially nipples exposed to the heat; neither iron nor zinc nipples have answered for inverted burners—the latter melting. The regulating pin frequently stuck.

There have been some complaints of the meters made since the war broke out. Probably they have not been made with care, and may later serve as unpleasant mementos of the war. It has, however, been found better for the gas-works to provide a few good meters than to supply gas at a fixed rate per point. The lack of solder and tin plant was very decided. Lead-coated sheet iron was used in place of tin plate, but soldering it was difficult and tedious, especially with the shortage of skilled labour. The new money counters, made in iron, have repeatedly been at fault, and are not likely to survive long. But generally speaking improvement is being effected as experience of the new conditions grows; and it is now reported that a quite satisfactory substitute for the brass burner, including the regulating nipple, is being put on the market. The very great rush of new consumers could not in all cases be met owing to lack of ordinary and prepayment meters. The difficulty was tackled in various ways—*e.g.*, by utilizing all unused or superfluous meters, by setting free meters, adopting a uniform price in place of differential prices for gas supplied for different purposes, buying up or repairing old meters, connecting a number of houses to a single meter, and by giving a supply at a fixed tariff per point connected. The services rendered by the meter makers, however, deserve recognition; for a great many more meters have been ordered and supplied than at any period of the same duration in peace time. If gas-works have been in arrear in meeting the unprecedented demand, it is perhaps the best evidence of the marvellous extension of gas supply which the war has effected.

Reduced Profits.

In almost all cases the profits of gas undertakings have fallen off—here and there a surplus has been replaced by a deficit. On the average, there appears to have been a reduction of about 30 per cent. in the net profit, and an increase of 3½d. to 7d. per 1000 cubic feet in the prime or net cost of the gas made. The latter increase is due to the high price of coal, the much greater cost of labour, and generally lower receipts. Coal alone has cost some 10s. per ton, or 60 per cent., more, and at the same time has given a lower yield of gas. Many undertakings have drawn on their reserve funds or reduced the amount set aside to cover depreciation. In numerous instances matters have been balanced by raising the price of gas, or by imposing a percentage war surcharge; and in other instances such steps are contemplated. It was ascertained by a circular-letter of inquiry sent out by the Central Gas Bureau in collaboration with the German Association of Gas and Water Engineers that about 36 per cent. of all the gas undertakings had increased the price of gas by 3½d. to 6¾d. per 1000 cubic feet, that about 10 per cent. were about to do so, and that about 54 per cent. have not decided on such a step or have gone over from differential prices to a uniform rate.

In most cases the increase in price has been made solely with a view to restoring the financial position of the undertaking to the peace time basis; but in a few instances it has been made in order to raise money for other municipal purposes. The latter procedure is risky, of dubious expediency, and commercially wrong. It is to be hoped that the price of gas will be raised only in those cases where it is imperatively necessary, and not merely by way of following a bad example. Otherwise sooner or later a reversion to electricity or petroleum will take place, with consequential reduction of the profit-earning capacity of the undertaking. It should, moreover, be emphasized that any increase in the price of gas is merely a war surcharge.

(To be continued.)

Hinge-Joints in Mains while Bridge-Moving.—In order to avoid shutting off the supply of gas to North Mankato (Minn.), during the shifting of two sections of a bridge over which the mains were laid, the Northern States Power Company decided to place hinge-joints in the mains, so that they could move in accordance with the bridge sections, and still carry on the supply of gas. The two sections of the bridge in moving were kept as one unit and treated as one span. One end was moved 44 feet, and the other end opened up only as a hinge. No trouble whatever was experienced in taking care of the gas supply, and no consumers were inconvenienced except for a short time one afternoon, while the hinge-joints were being placed in position.

American Research Council.—There has been established in the United States a National Research Council, which will be composed of leading American investigators, and engineers representing the various departments of the Government educational institutions and research foundations and research laboratories of industrial and manufacturing establishments. The work will include the preparation of a national census of equipment for research and of men engaged in it, the preparation of reports by sub-committees suggesting important research problems, the promotion of co-operation in research, and action with educational institutions by supporting their efforts to secure larger funds and more favourable conditions for the pursuit of research and the training of students. Among others, a committee has already been appointed in co-operation with American scientific societies to investigate processes for the fixation of nitrogen.

A NEW FORM OF KEITH LIGHT.

The "Duct" System.

Hitherto all "Keith" lamps have been fitted with their own injectors, nipples, and air-adjusters. In the new "Keith" system, which has been recently devised, mixed gas and air is supplied through a run of piping; the injector being fitted at the middle, or other convenient point, and a limited number of simple fittings connected at suitable intervals along the run. By this means, no nipples or injectors are required on the lamps or fittings themselves; and, in consequence, it is possible to employ lower candle-power units than was formerly the case, with entire freedom from the trouble often experienced with small-bore nipples and with accumulation of dust in the fitting.

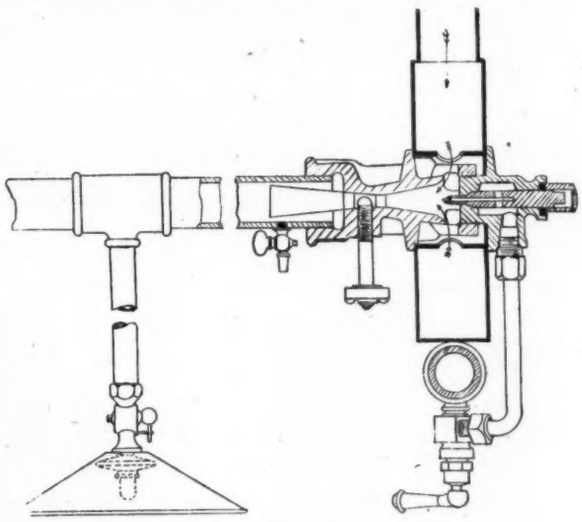


Fig. 1.

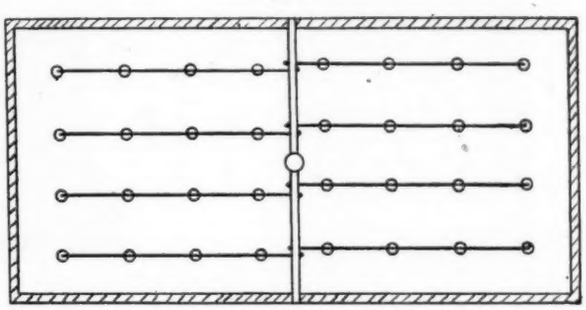


Fig. 2.

DIAGRAMS SHOWING (FIG. 1) THE ARRANGEMENT OF THE INJECTOR, AND (FIG. 2) A PLAN OF THE AIR-DUCT AND MIXTURE RUN.

This permits the use of a simple and inexpensive form of fitting. The lamp itself comprises the "Keith" patent heater, nozzle, and mantle, but without injector, nipple, or air-adjuster. Preferably a metal-frame reflector with opal slips is employed, which has the advantage of allowing a certain amount of upward light. The down-stem of the lamp is connected to the distributing pipe by a short length of flexible metallic tubing, which acts as an anti-vibrator. The grouping of the lamps described is an essential feature of the system; but where individual control of each lamp is required, the employment of the Keith standard fitting can be supplied from the same high-pressure service. This combination of the two systems enables all requirements in this connection to be met.

In factories where the dust problem has to be encountered, a modification of the system is found to entirely overcome the difficulties. This modification consists in enclosing the main injector within an air-duct, through which the supply of air to the burner may be drawn direct from the outside, or an adjacent part of the building where the air is not charged with dust.

Larger candle-power units, in all sizes, can be supplied, with the dual advantages of grouping and freedom from dust. It is not intended to supply globes with the new form of fitting; and a great saving in maintenance cost is thus secured.

In the Chemical Section at this week's meeting of the British Association at Newcastle-on-Tyne, Mr. C. H. Whitaker, a representative of British Dyes Limited, will speak on the "British Coal-Tar Colour Industry in Peace and War;" and there will be a demonstration by Dr. Thornton on the "Stepped Ignition of Gases."

MESSRS. JOHN WRIGHT AND CO.'S SEASON'S NOVELTIES.

The "Cabinet," "Chassis," and Other Types of Stoves.

One of the outstanding evidences of the wide-awake life that has of recent years permeated the gas industry is the crop of novelties in gas-fire design which autumn brings as regularly as it brings harvest. Amid various degrees of novelty of construction, and novelty of ornament, it is refreshing to find an apparatus which is not merely novel in these two respects, but is something of quite a new kind and intended for quite a new purpose. We have remarked on autumn bringing forth gas-fire novelties in the same way as spring produces the latest thing in cooking appliances. The new apparatus whose advent we have now to announce joins the cooking and the heating seasons together by undertaking to perform the work of both in a way which it is claimed (and, so far as we are aware, with the fullest justice) has never before been attempted.

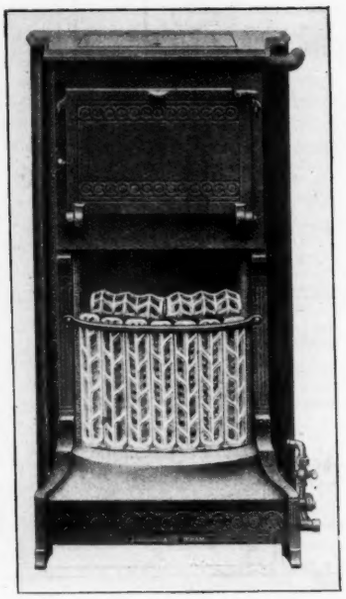
In summer, the fact that the cooking apparatus does not warm the apartment, and is not meant to do so, suggests no unwelcome limitation. But to meet the warming needs of winter, there have been arrangements contrived by several firms—including the makers of the new apparatus to be now described—to bring together a gas-fire and a gas-cooker. The new apparatus, however (which is named the "Cabinet"), offers all the advantages of a combination, as distinct from a mere aggregation. It is one apparatus performing two distinct functions—not two separate appliances for different purposes merely placed side by side. That being so, it has all the advantages of compactness, convenience, and sightliness of appearance, which only a specially designed combination could give.

In casting the imagination forward to the various uses for which the "Cabinet" is fitted, and the possibilities which it opens up, it is not easy to avoid catching something of the enthusiasm of its makers in their anticipations for its future. There must be countless thousands of weary workers with brain or with hands, who come home nightly to unlock the rooms they call "home," with the dreary prospect of kindling their own fire and cooking their own evening meal. A further prospect awaits them of next morning answering the unwelcome summons of the alarm clock, and engaging in the chilly duty of preparing breakfast under similar conditions. In every case of the kind, the "Cabinet," with its good "Thermo-X" gas-fire below, its griller of adequate cooking and boiling capacity above, and the spare heat from the fire economically utilized to help to warm the oven, brings good news of an urgent need at last amply satisfied. Wherever there are occupants of small flats, suites of chambers, or other premises involving what may be called kitchen operations under parlour conditions, the "Cabinet" cannot but prove a treasure. It is also peculiarly adapted for classes of special buildings such as cabmen's shelters, railway signal boxes, and other apartments of the "cabin" type.

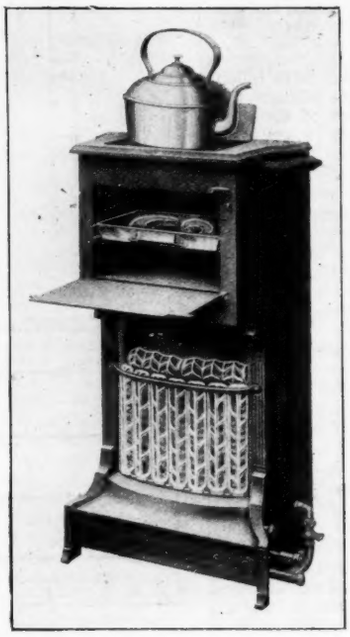
Turning to the details of construction, the griller (the illustrations show) has a door in front, which opens downwards, so as to form a convenient projecting shelf on to which the grill-pan can be drawn out for inspection purposes. There is an opening in the top—as is usual in "breakfast-cookers"—on which the tea-kettle can be boiled. This opening, when not in use, is covered by a hinged cast-iron lid, which closes-down flush with the stove top When this and the fall-down door are both closed, the apparatus becomes simply a gas-fire of neat and compact appearance. The grilling deflectors have the usual "rise-and-fall" movement, and there are, of course, separate taps to the gas-fire and the cooking burners respectively.

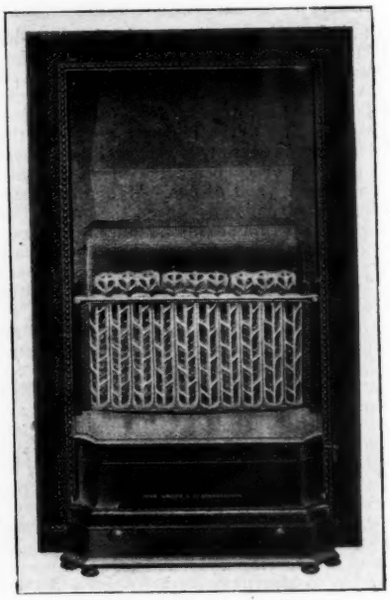
The makers of the "Cabinet"—Messrs. John Wright and Co., of Birmingham—are to be congratulated upon their introduction of so novel a class of apparatus; and if time should prove their confident anticipations as to the many new directions in which it will introduce the domestic use of gas to be as reasonable as they seem, then Messrs. Wright will not only reap the direct profit themselves, but will have deserved from the gas industry something of that grateful recognition proverbially given to those who "make two blades of grass grow where one grew before."

Of interest in a different manner and degree is another apparatus to which Messrs. Wright are calling special attention on the threshold of the coming winter. The claim in this latter case is not so much that of novelty, because the stove in question has been a twelvemonth or so before the public. It is rather the very fact of its having already won public favour. Preparations for its introduction had been well on the way when war came with its hampering effect upon output—particularly in the case of fresh apparatus; and hence the wide popularity which at once came to the "Chassis" fire on its introduction caused serious embarrassments to its makers, because of their difficulty in meeting the wide and steady demand without prejudicing the output of their existing standard stoves. Profiting by last year's experience in this connection, Messrs. Wright have, they inform us, carefully studied the best means of turning out the "Chassis" in large numbers, with the result that arrangements are now completed for promptly meeting all demands, so that not merely those "who want eight and who won't wait," but the many who, as in last season, wanted far larger quantities, will find no strain whatever upon their patience.



WRIGHT'S "CABINET" GAS-STOVE.





THE "CHASSIS" GAS-STOVE.

Of a fire already so well known as the "Chassis," any lengthy description would be needless repetition. It may suffice here to offer a reminder that the "Chassis" is no makeshift; and it is no attempt to imitate a coal-fire. It is a different thing from fires of the "basket" class. It efficiently and economically warms a room in the same way as an ordinary gas-fire does. Indeed, as its name (borrowed from motor parlance) indicates, it consists simply of the working parts of a gas-fire, with the minimum of necessary framework, so that when it is placed in position in a coal-grate, practically no metal-work—whether of good design or otherwise—is present to enter into competition with the design of the grate itself. The embodiment of the "Thermo-X" radiant in its fire-front, the entire concealment of all brasswork within the fender, the frontal gas adjustment, and the admirable back-brick arrangement for preventing any unsightly gap between the stove and the coal-grate, are among the outstanding virtues that have given the "Chassis" its instant popularity. And now that any uncertainty as to delivery has been eliminated, one may expect, as the winter advances, to see gas burning in many a grate where coal burned before.

Messrs. Wright report that the vogue of their "injector-ventilating" fire, which was so great last winter, has led to a continu-

ance of the demand for these fires throughout the past summer, and that prospects point to a greatly widened and general adoption of the "injector-ventilating" principle. This principle is now applied to every one of Messrs. Wright's ordinary gas-fires—the only exceptions being special apparatus such as the "Cabinet," the "Chassis," and some dog fires. Messrs. Wright's patent noiseless burner is also applied to their fires without exception; and in this connection we are reminded that in these times when calorific values are having to be somewhat lowered, the injector which forms part of Messrs. Wright's burner lends itself particularly to the necessary adjustments which this entails.

SCIENTIFIC AND INDUSTRIAL RESEARCH.

THE Committee of the Privy Council for Scientific and Industrial Research, established a little more than twelve months ago, have submitted to His Majesty their first annual report, for the year 1915-16. The document is a lengthy one; the greater part of it being taken up by the report of the Advisory Council. The amount placed by Parliament at the disposal of the Committee was, for the initiation of the scheme in the year under review, £25,000, and for the current financial year £40,000. So far, it has been decided to grant aid to twenty scientific investigations of industrial importance, one of them being the refractory materials research under the auspices of the Institution of Gas Engineers—as was fully explained by Dr. H. G. Colman at the June meeting. In addition, grants have been approved to about forty individual research workers.

The Advisory Council, in their report, explain the principles which have guided them in their work, call attention to some of the difficulties which will have to be overcome, and record the spirit of goodwill and co-operation with which they have been met. The more important conditions which seem to them necessary for the success of their work, are a largely increased supply of competent researchers, and a hearty spirit of co-operation among all concerned—men of science, men of business, working men, professional and scientific societies, universities and technical colleges, local authorities, and Government Departments. They regard it as certain that the number of trained research workers who will be available at the end of the war will not suffice for the demand which they hope will then exist; and the responsibility for dealing with this situation, they say, rests with the education departments of the United Kingdom. The Committee will be able to do something to encourage a longer period of training, by the offer of research studentships, &c.; but this will not suffice, because it is useless to offer scholarships if competent candidates are not forthcoming. Steps have now been taken by them for the formation of a register of researches.

As to the second condition mentioned in the report as necessary for success, the Advisory Council point out that there are specially strong reasons for more co-operation between the various British firms in each industry, and between the industries and the State, in the furtherance of that fundamental research which requires a very large expenditure on brains and equipment, as well as continuous effort. Some form of combination for this purpose (and also for the provision of pensions or clubs, which the small firms find it difficult to establish) they believe may be found to be essential, if the smaller undertakings of the country are to compete effectively with the great trusts and combines of Germany and America. Though the economic problem lies outside the province of the Council, the remark is made that, "as people have learned to combine against the risks of fire or shipwreck, without losing either initiative or freedom, so firms may come to look upon expenditure for research as a necessary kind of insurance. It is certain that the costs to be met will, on any adequate estimate, have to be counted, not by tens of thousands, or even by hundreds of thousands."

There are a number of appendices to the report; one of them being a memorandum on suggestions made by the Governments of Victoria and New South Wales for rendering the scheme for the organization and development of scientific and industrial research applicable to the whole Empire.

Coals of Japan.—A considerable amount of information with regard to the coal mines of Japan is contained in an article which Mr. Watson Smith contributes to the "Journal of the Royal Society of Arts." Speaking of the Miike coalfield, he says the coal has a brownish lustre, and is highly bituminous. Owing to its great steaming power, high heating value, and uniform quality, it has acquired the reputation of being the standard coal on the Asiatic markets. The fine coal is peculiarly fitted for forging purposes, and commands a wide market both at home and in Chinese ports. The gas producing power of Miike coal has long been recognized by gas-works in Japan and China. It cakes easily, and coke of excellent quality is made in Koppers regenerative coke-ovens, with a bye-product plant installed at the colliery. The average results per ton are: Coke produced, 1500 lbs.; gas, 11,000 cubic feet; coal tar, 166 lbs.; and ammonium sulphate, 21·3 lbs. There are at the Miike colliery 92 Koppers regenerative coke-ovens with a bye-product recovery plant producing over 100,000 tons of coke and 1420 tons of ammonium sulphate per annum, besides coal-tar products by distillation of the tar.

NOTES ON BYE-PRODUCT COKING.

[Communicated.]

THE LABOUR QUESTION.

IN common with most other industries, labour troubles exist in the bye-product coking industry; and it is not at all unlikely that the coming winter will witness much industrial strife, unless a better understanding than exists at present is arrived at between masters and men. The whole position needs very careful handling; and although one may be of the opinion that the men are none too wisely led, or that the masters are perhaps a little too exacting, it must be borne in mind that there are invariably two sides to every question. In any successful enterprise there is always the feeling that the men are not getting their fair share of the profits. This is the labour view; and, consequently, an increase in wages is applied for. On the other hand, times are not always good, and the masters have to pay the same wages whether trade is good or bad. Consequently, they oppose any increase. So we go on—first one side for an increase, then the other for a reduction.

There is a widely prevalent opinion that at the present time bye-product coke-ovens are making exorbitant profits, and that, consequently, the time is ripe for an increase in wages. Regarding the coke-ovens as independent units, a careful analysis of the figures will prove that in the majority of cases the position is by no means so rosy as it looks. This is not to say that no profit is being made; but a reasonable one is allowable. The coke-oven industry is a complicated one from the labour standpoint, and a thorough reorganization of the union rules and classifications is highly desirable in the interests of masters and men. Different districts have different standards of work, different grades of pay, and entirely different working arrangements; and endless confusion and trouble are caused because what holds good in one district does not hold good in another. Durham takes the lead in most things pertaining to bye-product coke-oven union affairs, and the Durham standard is far from being a desirable one.

In the opinion of the writer, all the worst features of trade unionism—and there are some bad ones—are pushed forward to the detriment of the industry. With genuine trade unionism he has no quarrel; but when it embodies deliberate limitation of output, then he does not believe in it. He also agrees that the coke-oven man has every right to as much wage as he can get—by legitimate means. The classification of the men also leaves much to be desired. There are very few posts on a coke-oven plant in which men can really claim to be what is usually termed skilled men, and yet the rates of pay are considerably higher than those of many highly-skilled trades. There is no serving three or four years of apprenticeship at a low rate of wages. Frequently a boy of 15 or 16 could easily do the work done by a man, and do it better than many; but the Union steps in and says that it is a man's job, and a man's wage must be paid.

In Durham, the ram-driver is one of the best paid men. This is a very simple job in reality, and can be learnt by any intelligent man in an hour. Even admitting that coke filling is a heavy job, after all, it is only labourer's work, and girls often do it in Scotland, and do it quite well too. All the men then on Durham plants are classified at certain rates of wages for certain work. Now come South, into what is termed the West Yorkshire area. Here the rates of pay are much lower, and the grading is totally different. The highest paid man is the coke filler! Men who are doing really intelligent work, such as the exhauster man, gas regulator, &c., are paid considerably less, and yet they are frequently a far superior class of men. In Durham, there is limitation of output. Only a certain number of ovens must be pushed per shift, unless a bonus is paid. In most cases the specified number of ovens could be pushed in three-quarters of the shift; but the pernicious bonus system will not allow it. The principle is wrong, because the extra number can be, and frequently is, done without any undue effort on the part of the men. In the West Yorkshire district there is as yet no actual limitation of this kind; but the Union are doing their level-best to establish it, although the men have been known to declare that they can do the full number comfortably. Mechanical means of handling doors, &c., have been introduced and improved since fixing the original standard, and considerable revision would not be out of place.

Another Durham evil which is not prevalent to the same extent in other districts is the "one man one job" idea carried to extremes. If a usual one-man job on a new plant, through some unforeseen circumstances, has to be started as a two-man job, it is only with the greatest difficulty in the world that it can eventually be brought down to the one-man standard. In South Yorkshire, the rates of pay and the grading of the men differ from those of Durham and West Yorkshire. They come approximately midway between the two; and the idea of limitation is getting a firmer hold. The Unions are organizing very strongly, and they are attempting to place things on a more consistent footing all round, based on the Durham standard. Here lies the danger, and the masters should not lose the opportunity of eradicating the worst features of the Durham rule.

There is a need, as pointed out above, for a complete reorganization of the grading of the men; and this can best be done by agreement between masters and men. One suggestion is that a joint arbitration board with an independent chairman be appointed to deal with the matter; but the chairman must be someone who thoroughly understands the coking industry from the

inside. It is thought the men intend putting forward a comprehensive scheme in the near future which embodies a minimum wage of 5s. 6d. per shift of eight hours, with overtime pay from Saturday noon to Sunday midnight and the addition of existing percentages. This claim is certainly not a modest one, and the majority of plants could not afford to grant the increase which this would involve. There have already been a few small strikes in connection with it, and more are threatened. Still another very important point was put to the writer a few weeks ago by a coke-oven manager who had to deal with it. A new plant was started, and a considerable number of men were engaged who had not previously worked on coke-ovens—the majority of them being labourers drawn from the engineering and general building trades. Owing to the inexperience of these men their work was inefficient, and many difficulties cropped up which would have been avoided by experienced men. In addition, extra men had to be set on to cope with the work, and extra supervision on the part of the foremen and management was necessary.

At the outset, the standard rate of wages for the district was paid, and the men received more money for less work than many of them had been accustomed to. Still the work was inefficiently done, and complaints came in from all sides. Then a rise in wages was awarded by the Conciliation Board. The management paid the rise only to those men whom they considered to be efficient, and not to the rest. The Union immediately took the matter up and demanded the increase to be paid all round. They admitted the inefficiency of the men in question, but regarded the point as one of principle. In the end, the men got the rise and all the arrears paid up. This is a very interesting point, and is one which should be fully considered in any future settlement. In reality it is placing all men, both efficient and inefficient, on a level, and cuts out all incentive to a man to try and improve. If a man is stopped for inefficiency under these circumstances it is victimization, and again there is trouble.

Pyrometry on Coke-Oven Plants.

Twenty years ago, a pyrometer was more or less a curiosity from the industrial point of view, and it was an instrument used only for academic purposes and scoffed at by the so-called practical men. To-day no up-to-date iron and steel works is without its full range of pyrometers at every possible point, and much useful information is gained as a result of their employment. The old steel-furnace hands judged their temperatures by eye; and it must be admitted that their judgment was remarkably accurate. Some places, however, are not accessible, and this method of temperature control is not permissible. In such cases a pyrometer is invaluable. On coke-oven plants, the use of pyrometers has not been developed to the extent that it might be. In Germany, these instruments are frequently installed not only for measuring high temperatures on the ovens, but also for recording the temperatures at various important parts of the bye-product plant. By this means a continuous and comprehensive record is obtained, which is of the utmost value in controlling the working of the whole plant, and obtaining the highest possible efficiency. Where they are installed in this country, the best use is not always made of them. It really is not the slightest use merely recording observations and leaving it at that. A proper working standard must be fixed and any deviation from that standard accounted for and the necessary correction made.

At many plants in this country a recording pyrometer has been installed which indicates the temperature of the hot waste gases going up the chimney. In the case of regenerative ovens this may be usually about 300° C. But in how many cases is any notice taken if it fluctuates (say) from 250° C. to 350° C.? In the majority of cases known to the writer, no notice is taken, and the indicator diagram merely serves as a check on the changing over, and also shows if the chimney damper has been short in case the gas has had to be cut off the ovens. Various types of pyrometers are available. For work on the ovens an optical pyrometer is most suitable, as readings can readily be taken in the various flues and oven walls.

Very few coke-oven managers have an accurate idea of the temperature of their ovens, flues, &c. A little work with a pyrometer would give them this, and enable them to satisfy themselves that they were not overheating any portion of the brickwork, or, on the other hand, that the heats could safely be increased if necessary. On the bye-product side it is useful to have a pyrometer on the outlet flues of gas-fired boilers in order to ensure that the maximum amount of heat is being extracted by the boiler and the minimum going up the chimney. On the sulphate plant (especially in the case of direct-recovery), an even temperature is desirable for smooth working. Men are apt to get careless and neglect this, or read the thermometers to suit their instructions. A recording pyrometer overcomes all trouble of this kind, and the manager always has before him a permanent record of the temperature—the human element being entirely eliminated. Rock salt troubles are frequently caused by irregularities in temperatures, and a visible record is a great help to the man in charge. Numerous other points where a temperature record would be useful will readily suggest themselves.

Factory lighting is dealt with, in a manner which should prove very useful, in the September number of "A Thousand-and-One Uses for Gas," published by the British Commercial Gas Association. There are many facts and illustrations relating to actual installations of gas lighting—both high and low pressure.

BENZOL PRODUCTION IN THE UNITED STATES.

Dealing with the greatly increased output of bye-products from American coking plants in 1915, "Gas Age" (New York) says the recovery of these bye-products made big advances in that year, and has now attained the proportions of an important industry. The value of these bye-products in 1915 was nearly $30,000,000, a large increase over the previous high-water mark of $17,500,000 in 1914. Though there were material increases in the output and value of gas, tar, and ammonia, which was to be expected with a greater output of bye-product coke, the increase in benzol products was remarkable, and presented the most interesting feature of the year in the coke industry. The value of these products rose from less than $1,000,000 in 1914 to more than $7,760,000 in 1915, according to Mr. C. E. Lesher, of the United States Geological Survey, Department of the Interior. Benzol has been recovered in America from coke-oven gas for a number of years; but prior to 1915 the market was small, and the prices low.

The awakening of the American people to the need for a dye industry and to a realization that such an industry cannot spring full-grown from nothing, but must be fostered and developed, is now a well-known story. Few are aware, however, of the progress that has been made within a year in laying the foundations for future progress in this industry. Under the spur of almost fabulous prices for benzol products, retort coke-oven plants throughout the country quickly installed elaborate benzol-recovery systems, and now save the valuable oils that not so very long ago were being burned or wasted, or, if saved, were begging for a market. In 1914, there were fourteen benzol plants in the United States; but they were all controlled by one company, and therefore it is not feasible to publish the statistics of their production for that or previous years. Last year, sixteen additional coke-plants were equipped with benzol apparatus, and the output was very greatly increased.

The benzol products obtained in 1915 amounted to 16,600,657 gallons. More than 13,000,000 gallons of the total output was reported as crude light oil, and had an average value of 33 c. Some of the plants have their own stills and refineries; and the pure benzol reported from these sources amounted to 2,516,483 gallons, with an average value of nearly 57 c.—at least three times the value of crude benzol before the war—and 623,506 gallons of toluol, with an average value of $2·45 a gallon. Crude benzol, which in 1914 was used to some extent for motor fuel, contained the toluol, which is now separated out and sold at fancy prices. More than 138,000,000 gallons of tar were in 1915 obtained from coke-ovens, and sold for $3,568,384.

The ammonia, of which nearly 100,000 tons was reported as sulphate and the remainder as liquor and anhydrous ammonia, brought a total of $9,867,475 to the producers. Surplus gas to the extent of 84,356,000,000 cubic feet, valued at $8,625,000, was sold or used. Of this quantity, 17,196,000,000 cubic feet were used as illuminating gas, 27,591,000,000 cubic feet as domestic fuel, and 39,569,000,000 cubic feet as fuel for steam raising, open-hearth furnaces, gas-engines, and other industrial purposes.

These bye-products, which had a total value of $29,824,579, were obtained by the carbonization of 19,500,000 tons of coal, from which were also obtained 14,000,000 tons of coke, valued at $48,500,000. The total value of the coke and bye-products was more than $78,300,000.

Illinois Gas Research Fellowship.

The Illinois Gas Association are to pay to the University of Illinois the sum of $500 for a period of four years, to establish a research fellowship in gas engineering. The results of the investigations that may be carried on by the Research Fellow in Gas Engineering shall be the property of the University for dissemination to the public through such channels as they may select; and reports of work done are to be rendered to the Association. The appointment to the fellowship will be for a period of two years, with a stipend of $500 a year. The officers of the various companies represented in the Association will be requested to nominate for fellowship one or more members of their staff who are graduates in engineering from a technical school; and the list of names thus secured will be transmitted by the Secretary to the Director of the Engineering Experiment Station of the University, who will nominate, from among those who meet the University's requirement for admission to graduate standing, the candidate who gives the largest promise of success in research in gas engineering.

Factory Accidents.—It is announced by the Factory Department of the Home Office that as from the beginning of this week it will not be necessary for the occupier of a factory or workshop to notify any accident to the certifying surgeon. Accidents must, however, be notified as before to the district inspector of factories. The certifying surgeon may be required by the inspector to report upon certain accidents, and for this purpose will have the same powers as in the past. Notice of every case of lead, phosphorus, arsenical, or mercurial poisoning, or anthrax, occurring in a factory or workshop must still be sent to the certifying surgeon, as well as to the inspector; and this requirement now applies also to cases of toxic jaundice—that is, jaundice due to tetrachlor-ethane or nitro or amido-derivatives of benzene or other poisonous substance.

NORTH BRITISH ASSOCIATION OF GAS MANAGERS.

ANNUAL MEETING, EDINBURGH, FRIDAY, SEPT. 1.

PRESIDENT: MR. ALEXANDER MASTERTON, OF EDINBURGH.

THE Fifty-Fifth Annual General Meeting of the North British Association of Gas Managers was held on Friday last, in the Royal Arch Halls, Queen Street, Edinburgh. Mr. ALEXANDER MASTERTON, the Gas Engineer of Edinburgh, the President, occupied the chair; and quite a hundred members were present. The Chairman was accompanied to the platform by Sir Robert Inches (Lord Provost of Edinburgh), Bailie Lindsay (of Edinburgh), and Mr. John Lang (of Alexandria).

A CIVIC WELCOME.

The PRESIDENT said they felt highly honoured in having with them Sir Robert Inches (the Lord Provost of Edinburgh, and the Chairman of the Gas Commission) and Bailie Lindsay (the Convener of the Works Committee). These two gentlemen took a deep, active, and kindly interest in the gas undertaking in the City of Edinburgh; and it was a matter of much gratification to him personally that they both found it convenient to be present.

Sir ROBERT INCHES said he was there for the purpose of extending to the members a hearty welcome to the City of Edinburgh. Edinburgh was a city full of romance, full of the history of Scotland, and dear to every Scottish heart. Those of them who had time would do well to visit the gas-works. He was quite sure that, under the guidance of Mr. Masterton and Mr. Herring, they would find at their various gas-works there was a considerable amount to learn. Further, they would go away from the city fully impressed that in Edinburgh there was a gas undertaking which was not only up to date, but quite up to the "crack of the whip." As Chairman of the Gas Commission, he could assure them that his fellow Commissioners would welcome them to the works, and would do everything they could to facilitate their investigations. He hoped the meeting would lead to the diffusion of light—even more light—and do something to prevent the rise which some people seemed to anticipate in the price of gas. He welcomed them to the city, and hoped they would carry away pleasant recollections of their visit to one of the most beautiful cities in the Empire. [Applause.]

Mr. JOHN LANG (Alexandria) proposed a vote of thanks to the Lord Provost and Bailie Lindsay for their courtesy in attending the meeting; and the compliment having been cordially acknowledged, the civic representatives withdrew.

THE REPORT OF THE COUNCIL.

The Council, in their report, said that the membership of the Association at June 30 was 258, as compared with 253 at the close of the previous year. There are 164 ordinary members, 14 associate members, 73 extraordinary members, and 7 honorary members. Intimation was made of the death of three ordinary members (Messrs. Dugald Currie, of Campbeltown, Thomas Ward, of Stevenstown, and Alexander Ross, of Burntisland), two extraordinary members (Messrs. Joseph Hepworth, of Edinburgh, and Robert R. Penman, of Glasgow), and one honorary member (Mr. Adam M'Pherson, of Edinburgh).

The following were recommended for membership:

Ordinary Members.—Messrs. John R. Gentry, of Gourock, James Jameson, of Thornliebank, W. Mann, of Auchterarder, John W. M'Lusky, of Airdrie, R. M. Simpson, of Buckie, and George Porteous Mitchell, of Port Glasgow.

Extraordinary Member.—Mr. Geo. R. Hislop, Jun., of Paisley.

Transferred from Associate to Ordinary Membership.—Messrs. David Fulton, of Helensburgh, and H. H. Gracie, of Edinburgh.

Mr. Alexander Masterton has been appointed to represent the Association on the Council of the Institution of Gas Engineers for the year 1916-17.

The Council recorded, with pleasure, that a fully-equipped motor ambulance car was publicly presented to the British Red Cross Society (Scottish Branch), in Glasgow, on Feb. 2 last, by Mr. Masterton. The car was subscribed for by gas engineers and managers of gas-works, employees of gas-works, town councils, gas companies, and firms connected with the gas industry.

The reports of the two Commercial Sections—signed by the respective Secretaries, Mr. R. S. Johnston and Mr. James Bell—were included. The report of the North-Eastern District Section contained the following statement: Recently the Committees of the Commercial Sections held a joint meeting in Glasgow, to discuss the question of coal supply and other matters of importance. A Committee has been appointed to collect information regarding coal supply at the various gas-works, and, should the necessity arise, will appeal to the Coal and Coke Supplies Committee for Scotland, with a view of having the interests of the gas undertakings of Scotland safeguarded.

During the financial year ended June 30, no application for assistance from the Benevolent Fund was received. The amount at the credit of this fund is £717 18s. 9d.

A Sub-Committee of the Council have been making inquiries in reference to the forming of a national gas-testing laboratory for Scotland.

The PRESIDENT, in moving the adoption of the report, said it was interesting to note that the membership had been slightly increased during last session; but, on the other hand, he felt sure they all deplored the losses they had sustained by death. He was pleased to say they had secured a number of new extraordinary members, whose presence would add strength to the Association. They would observe that the Red Cross ambulance car which the Association decided to provide was duly handed over to the British Red Cross Society in Glasgow last February, in the name of the Scottish gas industry. It was a pleasure to feel that they had all been associated with such a worthy object, and that little time was lost in collecting the necessary funds and handing the car over for its noble and patriotic work. From the report it would be noticed what was said in connection with the Commercial Sections, and also that a Sub-Committee had been formed to deal with proper supplies of coal for gas-works purposes, and that, should it be found necessary, an appeal would be made to the Coal and Coke Supplies Committee in order to protect the gas undertakings of Scotland. Turning to the financial side, it was satisfactory to record that the affairs of the Association were in a sound condition, and that the funds were £75 better over all than they were at the close of the previous year. It would be admitted that it was a judicious decision to omit from the annual meeting on this occasion a "Young Memorial Lecture," considering the unfortunate circumstances still prevailing; but it was a matter of satisfaction that they had secured some excellent papers from among their own members. With reference to the proposal to set up a national gas-testing laboratory in Scotland, the Council had been in communication with representatives of the Glasgow Technical College and the Heriot-Watt College, Edinburgh; but, owing principally to the large amount of capital outlay which would be involved, neither of these institutions could see its way to entertain the proposal meantime. They had, however, prepared a schedule of the most important work required in this direction. It had been submitted to a number of prominent chemists in Edinburgh and Glasgow, asking them to fill in rates for the various items; and as soon as the replies came to hand, and had been considered by the Council, the question would again be brought before the members.

Mr. A. P. MYERS (Saltcoats), in seconding the adoption of the report, said he would take the opportunity of suggesting to the Council whether it would not be wise and expedient to release the funds invested in North British Railway stock and transfer them for Government scrip. He merely threw out the suggestion for consideration by the Council.

Mr. S. B. LANGLANDS (Glasgow) hoped it would not be at the next annual meeting that they would first hear the outcome of the Council's inquiries regarding the proposal to set up a national gas-testing laboratory. Now was the time when the question of a laboratory became one of big moment, and he trusted the Council would keep the members fully informed in regard to the progress of their negotiations.

The PRESIDENT explained that the Council were pushing along their inquiries as fast as they could. There had undoubtedly been a little delay in getting satisfactory replies to the various communications sent out. As soon, however, as the schedules were returned to them, they would have a meeting of the Council, and the decision would be duly intimated to the members.

Attention was drawn to the decrease in revenue during the past two years; and it was pointed out that there had been a considerable drop in the subscriptions received from extraordinary members.

The PRESIDENT observed that a large number of extraordinary members had recently been secured; and this accession would materially help to bring up the funds. He did not think it would be judicious at the present juncture to raise the subscription rates to ordinary members. Then, as a further explanation of the drop in revenue, they had to keep in view the fact that they were now living in somewhat difficult times; and the cost of paper and printing had to a large extent influenced the expenditure.

The report was approved.

The PRESIDENT then delivered his

INAUGURAL ADDRESS.

Gentlemen,—When you did me the honour of electing me President of your Association in September last year, I thanked you then; and now at this stage of the proceedings I should like, just in a sentence, to express to you my gratitude and indebtedness for the distinction you have conferred upon me. This office has been held in past years by men of no mean order—men who have

added lustre to the position by the worth and nobility of their character; and it has been my humble endeavour, in fulfilling the duties of the presidential chair, to follow in their footsteps as far as possible, and I feel proud to have my name placed alongside such predecessors.

THE LATE SIR CORBET WOODALL.

I would ask you to pause with me a moment to refer to the sad event which occurred in May last, and which is closely connected with the gas profession. I refer, with regret, to the death of Sir Corbet Woodall, D.Sc., M.Inst.C.E., the Governor of the Gas Light and Coke Company. Many appreciations of him and his work have been written, and to add another may seem superfluous. But we must not allow this occasion to pass without expressing our admiration and respect for the late honoured head of the profession. He was born to be a leader; he also was a capable organizer and a clever engineer. Added to these gifts he was a man of sterling qualities and naturally of a gracious personality. To those who knew him, either in a public or private capacity, his memory is cherished as a faithful friend, ever willing to help with his matured wisdom and ready sympathy. We mourn his loss to the gas industry. We know that he did his part nobly; and though the workman is removed the work must go on, and we now enshrine Sir Corbet Woodall among our cherished pioneers. I may mention that, on behalf of the Association, the Secretary and I sent a letter of condolence and sympathy to Lady Woodall at the time of her bereavement.

EFFECTS OF THE WAR ON THE GAS INDUSTRY.

Our thoughts during the past two years have been mainly occupied with the changes and effects which the war has brought about in the gas industry and the various new problems which have had to be faced by engineers and managers; and it has occurred to me that we ought to preserve a record among our "Transactions" of the numerous difficulties which have arisen, and the manner in which these have been dealt with.

Our attention was first directed to the necessity of providing men for His Majesty's forces. Most of us had a number of reservists and territorials in employment who were immediately called out, and steps had to be taken to relieve them of their duties and rearrange the staff. In addition, there was a considerable number of men who volunteered for service; and every encouragement was given in this direction. From the records of the various gas corporations and companies, it will be gathered that the status of these men and others joining the forces later on received prompt and generous consideration; and in the case of my own Commissioners, it was decided that all men called up or leaving to join the forces should not be in a worse position than if they had continued in the Commissioners' service. It was also agreed that their positions would be kept open for them whenever they were free to return; and as we have a superannuation fund, it was decided that the period of service with the Colours would be calculated for superannuation if the regular contributions were duly maintained.

The Commissioners determined to make up the difference between the allowance given by the Government and the wages which the men were receiving at the time of enlistment; and in the case of those with dependants, 7s. per week were to be deducted from the allowance given by the Navy or Army before reckoning the amount to be granted by the Commissioners. These moneys were to be paid over to the wives or other dependants of men called up. This arrangement worked well for a time, and as long as men could be secured to fill the places of those who had joined the forces. A point was, however, reached as the winter of 1914 approached, when it was found inconvenient, and almost impossible to dispense with further employees; so that it then became necessary to put a restriction on additional enlistments. Thereafter, any men wishing to join were only permitted to do so on obtaining the consent of the head of their department, whose duty it was to see that proper arrangements were made for the carrying on of the essential operations. At the outset, the allowances amounted to, approximately, £5000 per annum, but have since reached a yearly total of £7000. As time wore on, and more men were needed, it was gradually foreseen that it would not be possible to effectively maintain the work of the undertaking without having recourse to female labour; and immediately this was recognized, young women and girls were engaged, specially in the clerical departments, to fill up temporary vacancies.

It soon became apparent that, for the proper protection of the public and for the regular manufacture and distribution of the gas, a certain minimum number of men would have to be retained. With this object in view, representations were made to the Government by the principal gas and electrical undertakings to recognize the importance of these industries and give such instructions to the recruiting officials as would prevent these men being pressed to enlist. The Government had now begun to realize the assistance the gas industry would be to them in the prosecution of the war, and in the supplying of some of the essential ingredients for manufacturing high explosives; and they were soon convinced of the necessity of retaining tradesmen and skilled workmen for these purposes. At length they consented to provide badges to show that these employees were engaged on war work.

It then became imperative to show that, along with the skilled workmen, a number of handy men and labourers trained for certain classes of work were indispensable; and these also were partially exempted. It was, however, with the greatest difficulty that badges could be obtained for a few of the skilled fitters in the distribution department; and for some time it was not quite clear that these men would be entirely reserved for us, although the position from our point of view was perfectly logical—viz., that if gas requires to be manufactured in order that chemicals for high explosives may be produced, it is just as essential that gas should be properly distributed, and that the appliances for so doing should be fitted, repaired, and maintained in proper and safe working order.

The preparation of the National Register and the enlisting of men under the Derby scheme were responsible for considerable dislocation of labour and uncertainty as to the future; but by dint of perseverance and keeping in close touch with the numerous movements, and the bringing before the various Government departments the urgent need of retaining certain classes of men who had become irreplaceable, we have managed to continue without interruption. And I think I am safe in saying that those in authority have reached a proper perspective of the facts, and are anxious and willing to meet all reasonable requests. The coming winter will, no doubt, severely tax all our resources to keep pace with the demands.

At this stage it would be appropriate to glance at the question of labour, and to comment on the unrest which, unfortunately, manifested itself among the working classes. Even before the war commenced, my Commissioners, in common with many other employers of labour, had been the recipients of several overtures from various departments for increase of wages; and the free handling of the labour problems as between the master and the workman has been somewhat complicated and interfered with by combinations, especially in our case by the National Union of Corporation Workers—an Association founded some years ago, with branches in many of the principal towns.

The effects of the Union have been to interfere somewhat with the free management of gas-works and other corporation departments, by taking up comparatively trifling incidents which are almost inseparable from the conducting of a large business—indeed, it has been the means of causing a vast expenditure of unnecessary labour and energy among the administrative staff in the preparation of detailed statements, reports, statistics, and comparisons with other towns.

To quote a few of their demands, and the extent and nature of them, I might mention that the distribution department men, through the Union, applied for "country money" when working in outlying districts. Our custom has been for the men to travel to and from their work one way in the Commissioners' time and the other way in their own. In all cases, however, where cars or trains were available, the Commissioners defrayed the cost of them; and from a large number of inquiries which I instituted among other gas-works, I did not find a set of workmen more favourably treated. Nor were the deputation from the Union, when questioned on the subject of country money, able to give the name of any gas undertaking where this was being paid. Finally, my Commissioners determined that for all work beyond the city boundaries the regular hands should travel one way in the Commissioners' time and one way in their own—the full working day being wrought on the job, and the travelling time not to be reckoned as overtime, the Commissioners continuing to pay car and train fares. From the foregoing, it will be observed that the workmen can add to their pay at the end of each week by the amount of their travelling time, which may come to from four to six hours.

Another question was that of sick allowance, which it was suggested should be applicable to all employees. We learned from the engineers at other works that only men with upstanding wages were in receipt of sick pay; but in the other Corporation departments of Edinburgh some of the hands were receiving full pay for three weeks and half pay for the following three weeks—subject to deduction of National Health Insurance. It was likewise stipulated that a medical certificate of illness should be produced by the employee as soon as possible after leaving work, and another certificate stating his fitness when he desired to resume. These proposals were calculated to involve an additional annual outlay of £600.

The foregoing was followed by a general application from the National Union of Corporation Workers, requesting an increase of 1d. per hour to the whole working staff, which embraced men employed at the Granton Gas-Works as well as those on distribution. This request was based chiefly on the increased cost of commodities, and the inadequacy of the existing wages to meet the necessaries required, and, finally, on the general rise in wages which was taking place all over the country.

Considerable sympathy was felt with the demand on the ground of increased cost of living; and it was possible to determine with some degree of accuracy from the experience in the canteen at Granton works the extra outlay occasioned. From a statement showing the primary articles consumed and the comparative expenditure for one week for a man having two meals per day (breakfast and dinner), it was found that these cost 3s. 11½d. in 1914 and 4s. 5½d. in 1915—an average rise of 12½ per cent. It was recognized that this did not represent the entire expenditure in running a household; and another statement was made up, based on wholesale prices, giving comparative costs of foodstuffs required weekly for a family of four. This showed an increase of 24·3 per cent. The Board of Trade issued a circular which brought out the comparison between 1914 and 1915 of the staple articles of diet—an increase of 16·3 per cent. being shown.

After examining the matter from every point of view, and con-

sidering the Engineer's reports, the Commissioners determined to grant an allowance in the form of a war bonus of from 2s. to 2s. 6d. per week graduated as under, such bonus to continue to the expiry of one month after the declaration of peace, and not to be calculated as wages in respect of superannuation contributions.

To men earning from 20s. to 30s. a week, 2s. 6d. per week bonus.
" " " 30s. " 40s. " 2s. od. " "

These proposals represented an additional annual outlay of £3200.

Towards the end of last year, a further petition from the National Union of Corporation Workers was sent, requesting an increase of wages of 1d. per hour to all the men engaged at the gas-works and on the outdoor staff; the reason given being the continued rise in the price of commodities. Before this petition had been fully considered by the Commissioners, an additional communication was forwarded by the Union which asked that a deputation of their members should meet the Commissioners repeating their request for an increase of wages of 1d. per hour for all the workmen, and suggesting: (1) That this rise should be retrospective to date of application; (2) that it should be extended to men on Government service; (3) that the meter-readers' remuneration should be put on the same basis as the collecting staff; and (4) that all men in the employment should join the Union, failing which a ballot for a strike was to be taken. Later on, the Union withdrew the clause relating to the taking of a ballot for a strike; and the Commissioners eventually met a deputation and discussed the various questions raised. The foregoing increase asked for represented an additional annual charge of nearly £8200.

For the guidance of the members, it may be interesting to relate the privileges which the Commissioners' employees enjoy over and above their actual wages, and to note how the workmen view these.

(1) They have the benefit of the superannuation fund, to which they contribute 2½ per cent. of their wages, the Commissioners contributing another 2½ per cent. along with a fixed yearly sum of £2035—making a total contribution by the Commissioners last year of £3500.
(2) Every workman is allowed ten days' holiday per annum, with full pay.
(3) Every workman is granted a yearly allowance of three weeks' full pay and three weeks' half pay, less National Health Insurance payment, when he is incapacitated from work through illness.
(4) The workmen at Granton have been provided with a canteen by the Commissioners, who maintain and staff it and supply gas and steam for cooking free of charge. Meals are provided at moderate rates; a three-course dinner costing 5½d. Throughout the year, 50,017 breakfasts and 38,684 dinners were served at the canteen. There is also a portion of the Granton lands under cultivation, from which the men are supplied with potatoes and green vegetables—the Commissioners providing the labour.
(5) Hot and cold salt and fresh water baths, and elaborate washing accommodation, are provided for all the employees at the Granton Gas-Works.

It was stated at an interview which a Sub-Committee of the Commissioners had with a section of the workmen that, generally, the latter did not place any value upon the advantages and benefits they enjoyed under the Commissioners' conditions of service, and the Sub-Committee consequently recommended that the time had arisen for the Commissioners to consider whether they should now be withdrawn and the district trade rates of wages adopted, with the corresponding conditions of employment. It is interesting to note that the Commissioners were then paying war separation allowances at the rate of £6000 per annum. For the convenience of the Committee who were studying the wages question, a classification of the workmen was prepared in schedule form, showing their rates of wages, value of the various concessions, and the trade union rates. The Commissioners, in summing up, pointed out that the wages of their workmen compared favourably with those in other large towns, and that, taking into account the many advantages, they were quite equal to the local trade union rates.

It was felt that as the clerical staff had not received any consideration since the outbreak of war, and that their circumstances in several instances were even harder than those of the workmen who were already in receipt of a war bonus, their case should be taken up simultaneously. After due deliberation, the finding of the Committee was that the employees already in receipt of war bonus should be granted a further weekly bonus as stated hereunder, to be antedated as from Nov. 15, 1915, and representing an additional charge of about £1600 per annum.

	First Bonus.	Second Bonus.
Men having 20s. to 30s. per week.	2s. 6d.	.. 2s. od. per week
" " 30s. " 35s.	" . 2 0	.. 1 6 "
" " 35s. " 40s.	" . 2 0	.. 1 0 "

That the meter readers should have a bonus of 3s. 6d. per week, and that all employees forming the clerical and administrative staffs under the Engineer should have a bonus as follows: 3s. per week in the case of those having not more than 40s. per week salary, and of those having over 40s. and less than 43s. per week, the difference to be made up to that amount. The bonuses to be paid only to permanent hands not on war service.

Since that time matters in the labour department have been quieter, with the exception of the attendants on the Stirling boilers at the Granton works, who, being dissatisfied with the amount of bonus, demanded an immediate rise of ¾d. per hour in addition to the bonuses, failing which they threatened to go on strike. As there did not seem to be much prospect of replacing these men, and seeing that the Commissioners were engaged on urgent work for the Government, application was made to the Board of Trade, and a deputation of the Commissioners, accompanied by the Engineers, waited upon the Chief Industrial Commissioner in London and placed the whole of the facts before him. The attendants having agreed to suspend the strike notice and allow the case to go to arbitration, an Arbiter was appointed by the Board of Trade to hear parties. After the completion of his investigation, which included the examination of witnesses from outside firms, the Arbiter decided as under:

> And, further, having visited and inspected said Stirling boilers at the Granton Gas-Works, and having seen the general conditions under which said firemen work, I do now decide and determine that no good reason has been advanced for disturbing the existing rate of wages paid to said firemen in charge of the Stirling boilers, and said rate of wages shall remain on the present scale.

At the moment another application by the National Union of Corporation workers is pending. This takes the form of a further increase of 2s. per week to all employees, including the retort-house men.

WORKS PUT UNDER GOVERNMENT CONTROL.

For some time prior to this, the Commissioners felt that, owing to the importance of the work which they were performing for the Government in the extraction of benzol, toluol, &c., the difficulties they had experienced with labour, and the impossibility of securing further men trained to gas-works' routine, the Government might see their way to place the concern under the provisions of the Munitions of War Acts, 1915-16. For this purpose we approached the Ministry of Munitions and emphasized the importance of the various points enumerated, as also the number of munition factories and other industrial works within our area of supply using large quantities of gas; and I am pleased to inform you that the Ministry of Munitions issued a certificate, under section 9, 1 (*d*) of the Munitions of War (Amendment) Act, 1916, which states that:

> "The supply of light, heat, and power is of importance for the carrying on of munition work; and under this certificate the undertaking is subject to the provisions of part 1 of the Munitions of War Act, 1915, which prevents strikes and lock-outs, and the provisions of these Acts as regards leaving certificates apply to the undertaking."

I consider the foregoing a most important step; and I understand that many other gas undertakings throughout the country have secured similar certificates, which will place them in a secure position with regard to the retention of men requisite for the proper carrying on of the work. The Government also recognizes the indispensability of nearly all the men; and, to protect them from being called up for service, they have issued a number of war service badges and certificates among the skilled operatives, especially inside the gas-works. However, it is also satisfactory to record that, owing to the severe naphthalene troubles which arose in connection with the extraction from the gas of hydrocarbons for high explosives, the Government issued a limited number of badges and certificates to the distribution men.

EXTRACTION OF TOLUOL.

The war had not been long in process before it was realized that high-explosive shells would be required in large quantities, as the enemy apparently had immense resources in this direction, and that they were much more effective than shrapnel, and for this purpose, a vast amount of T.N.T., or, in chemical phraseology, trinitrotoluene, would be necessary. This compound is produced by the action of nitric acid on pure toluene. Toluol, from which the pure toluene is extracted, is one of the products formed in the destructive distillation of coal at high temperatures, and is contained in the coal tar as well as in the coal gas usually sent out to consumers. It also occurs, to a smaller extent, in the condensable hydrocarbons which collect in the syphons throughout the district. Toluol is one of the heavy hydrocarbons to which the gas is indebted for its illuminating value, and likewise, in a lesser degree, for its calorific intensity.

It will be readily realized that it was not long before it became apparent that the gas industry would prove an important factor in the preparation of the ingredients for high explosives; and a Committee of the High Explosives Department of the War Office, under the chairmanship of Lord Moulton, was formed to deal with this vital question, and to determine the best means of extracting this constituent from the gas and the tar. They had also to arrange with the various companies and corporations with regard to the provision of plant, and the terms and conditions under which the process could be worked, keeping in view the statutory limitations under which gas undertakings are generally carried on.

At the outset, it was recognized that considerable delay might take place in the preparation and erection of suitable machinery and apparatus for the different gas-works; and Mr. Charles Carpenter, D.Sc., the Chairman of the South Metropolitan Gas Company, devised a simple method for removing a large percentage of the toluol present in coal gas by washing the latter with coal tar at the standard temperature. All that was requisite was that a constant stream of tar should be passed through the

ordinary washers or scrubbers, and the gas brought into intimate contact with it—the flow of the tar being regulated in accordance with the quantity of gas being made.

The North British Association of Gas Managers, seeing the importance of the subject, called a special meeting of the members to discuss ways and means to comply with the urgent request of the Government, when it was unanimously agreed that an immediate response should be given, and that the maximum amount of toluol, consistent with parliamentary restrictions, should be taken out of the gas. Very little time was lost in having a number of works started on the extraction; and it was generally ascertained that either the existing plant could be adapted for the purpose with little expense, or that some old or disused apparatus could be requisitioned. This method of extraction is still proceeding in many of the smaller works. But it was deemed advisable for the larger works that other means should be devised; and to this end, it was considered that plants which had long been in use in connection with coke-ovens could be rendered suitable for the distillation of products removed from the gas.

The basis of the agreement between the Government and the gas undertakings was that the former would provide and fix the necessary machinery and appliances for washing or scrubbing the gas for the extraction of toluol and, where possible and economical, would also supply and lay-down apparatus for distilling and separating the various products. Where the gas concerns had already suitable washers at their works, these were to be taken over by the Government and interest paid on their value. All the working costs were to be borne by the Government; and the remuneration offered was to be at the rate of so much per gallon of pure toluene contents handed over. Another method of payment has recently been agreed upon, whereby the remuneration is to be at a fixed rate per gallon of distilled products recovered.

As the removal of toluol would undoubtedly impoverish the gas, it was suggested that an equivalent quantity of benzol to make up the deficiencies in the illuminating power and calorific value should be supplied by the Government. Negotiations had not proceeded far when it was discovered that the Government would not be in a position to fulfil this part of the bargain, as benzol had now become a valuable product in the efficient prosecution of the war; and it was imperative to look about for some means of providing an equivalent for the toluol and benzol which the Government now demanded. In the circumstances, an enriching spirit of the nature of petrol, and with a somewhat similar gravity and boiling point to motor spirit, was offered. Eventually it was decided, after some experiments, to try this carburetting agent on a working scale; and it has proved fairly efficient in the restoration of part of the illuminating power and heating value.

It will have been gathered that the gas industry, hedged about as it is by strict parliamentary restrictions, would involve itself in difficulties with the consumers unless means were adopted to indemnify its authorities from the claims and penalties which might be lodged against them; and the Government, appreciating the delicate position, issued an order, under the Defence of the Realm Act, indemnifying gas undertakings against all such claims and penalties, and recommending corporations and other testing authorities to discontinue the testing of the gas. Where this happened to be desirable, however, they advised that the results should not be published. Simultaneously, the Ministry of Munitions addressed a communication to local authorities explaining the urgent need for obtaining increased supplies of toluol and benzol for war purposes, and asking for the public indulgence, on patriotic grounds, for any inconvenience experienced. Nevertheless, every care and watchfulness are exercised in ascertaining that the gas sent out is of the highest available value. Tests are taken several times each day at the inlet of the benzol washers, the outlet of the station meter, the outlet of the carburettor, the outlet of the holder, and in the town itself.

In the agreement with the Government, a clause was inserted so that, at the conclusion of the war or at a short interval after the declaration of peace, gas undertakings would have the opportunity of acquiring the extracting, distilling, storage, and other plant specially installed for the preparation of toluol, &c. The basis of this transference was quite a reasonable one—viz.: What it would cost at the date of valuation to provide the plant new without erection and less depreciation for the time the plant had been in use. This figure was probably decided upon to relieve the Government of the charges in connection with the dismantling and removal of the plant and foundations and the restoration of the ground and buildings to their original condition. I believe at first it was thought that there was not much chance of many of these installations being so taken over; but as developments have proceeded and changes have occurred, I am almost persuaded that the acquisition would prove remunerative, as I think it is fully recognized, or soon will be, that the day of high candle-power gas is at an end, and that by extracting the products referred to a new source of revenue will be opened-up, the results of which will all go towards the manufacture of gas at a cheaper rate to the consumer without in anything like a corresponding degree diminishing the heating value or the available power.

It had first of all to be determined what class of oil would be most effective in removing the benzol and toluol from the gas; and in order to ascertain the value of various oils in this direction, a series of experiments were carried out at Granton on oil used for carburetting water gas, blast-furnace, anthracene, and creosote oils. It was finally ascertained that a light-grade coal tar or creosote oil—approximately free from naphthalene, and with a specific gravity of about ·986, similar to that used in coke-oven plants—was quite effective and reasonable in price. The further result of these experiments was to show that, after washing a coal gas of from 16 to 17 candles, the illuminating power was reduced to approximately 10½ candles, or 34½ per cent., whereas the calorific value was only taken down from 585 to 559 B.Th.U., or 4·5 per cent. When the oil was prebenzolized (with 5 per cent. of benzol added) before being put into the washer, the illuminating power was only brought down to about 15 candles, or slightly over 6 per cent., and the calorific value from 580 to 576 B.Th.U., or a little over ½ per cent. Later, when the Government commandeered the supplies of benzol, it became imperative to find some other hydrocarbons to reinstate the illuminating power, and at the same time keep up the calorific intensity; and the Government came forward with an offer to supply the petrol already referred to, which, when mixed with 10 per cent. of ordinary paraffin oil, was found to restore from 2 to 3 candles of illuminating power and also help to enhance the calorific value.

THE REQUISITE PLANT AND BUILDINGS.

We might now turn our attention to the machinery, plant, and buildings requisite for the extraction, distillation, and storage of the various products. In this respect we were favourably placed in having spare sets of Holmes's washer scrubbers, each of which was capable of passing 200,000 cubic feet of gas per hour, complete with foundations, driving engines, and connections to the coal-gas mains—these being situated immediately at the outlet of the ammonia extracting washers. With little alteration, these scrubbers were made applicable for the new process; and it was arranged that the Government should embody them with their other plant, paying an annual premium for their use. As we had no available apparatus for either distillation or storage purposes, the Government placed a contract for the supply and delivery of these; the Gas Commissioners undertaking the preparation of the foundations and the erection of the plant. To this end, a section of the residual products' works, which are situated on a lower level and at some distance from the main gas manufacturing site, was utilized, after removal of the machinery and appliances which had been intended for manufacturing other compounds of ammonia. The cooling pipes and storage tanks were erected outside, and in close proximity to, the main building.

After giving a description, accompanied by a very effective drawing of the toluol plant erected at Granton—and which, by request of the Ministry of Munitions, has been omitted from the "JOURNAL" reproduction of the President's address—Mr. Masterton proceeded to deal with

A DESCRIPTION OF THE PRODUCTS OBTAINED.

The following is a short description of the various products produced at the Granton works.

Benzol.

General appearance, yellow tinted, clear.
Odour, coarse, saturated with sulphuretted hydrogen
Sp. gr. at 60° Fahr., ·8729.

Distillation test, first drop at	70° C.
67 per cent. at	80° C.
97 per cent. at	87° C.

The benzol contains on the average:

Pure benzene ($C_6 H_6$)	75 per cent.
Pure toluene ($C_7 H_8$)	3 ,,
Loss by washing, &c.	22 ,,
	100 ,,

REMARKS: The benzol is a crude article which shows a loss of 18 per cent. on being washed with sulphuric acid and soda.

Toluol.

General appearance, very slightly tinted.
Odour, mild.
Sp. gr. at 60° Fahr., ·867.

Distillation test, first drop at	107·5° C.
57 per cent. at	100° C.
98½ per cent. at	112° C.

The toluol contains on the average:

Pure toluene ($C_7 H_8$)	86 per cent.

REMARKS: The toluol is a semi-crude liquid, much cleaner than the benzol. When washed with sulphuric acid and soda, there is a loss of 8 per cent. by volume.

Naphtha.

General appearance, yellow coloured.
Odour, coarse.
Sp. gr. at 60° Fahr., ·8902.

Distillation test, first drop at	136° C.
36 per cent. at	150° C.
63 per cent. at	160° C.
89 per cent. at	180° C.

The naphtha contains on the average:

Pure toluene	Nil.
Pure xylene ($C_8 H_{10}$)	50 per cent.
Heavy rectified naphtha (90 per cent. at 160° C.)	20 ,,
Naphthalene	11 ,,

REMARKS: The naphtha is a semi-crude liquid, and when washed with sulphuric acid and soda a loss takes place of 15 per cent. by volume.

Naphthalene.

General appearance, dark grey coloured salt, slightly damp.
Odour, coarse.
Melting point, 75° C.
Oil and water, 7 per cent. by weight.

REMARKS: This is a semi-crude naphthalene containing a small amount of oil and moisture.

NEW STANDARD FOR GAS.

It is suggested that the calorific standard for gas should now be accepted in this country. The reduction of luminosity mainly affects the flat-flame user, who represents only about 15 or 20 per cent., or even less, of the total consumers. This is a subject on which much has been written; but it has been neglected in many quarters, possibly on the old adage of "letting sleeping dogs lie." But seeing that the question has been forced upon us, it is well to examine it from all sides, and consider whether, in the event of it being possible, it would be wise to return to pre-war methods. Assuming that we decide otherwise, it appears to me that the bulk of the consumers will benefit largely, as with the lower quality of gas we would be able—again assuming that coal prices return somewhere near the normal—to manufacture and distribute it at much less cost; and it would be unfair to the majority to keep back such a progressive movement merely because a small percentage of our consumers would be adversely affected, and this on account of using obsolete appliances (flat flames). This, again, would put the gas industry into a strong position in the matter of competition for power, heating, and lighting business; and it is well known and accepted that the heat units in the gas are the essential elements in gauging its value as a power, heating, and light-giving agent.

Many of the London gas companies and others early foresaw this factor, and obtained parliamentary powers for the testing of their gas on the calorific standard. Although not a prophet, I feel safe in prognosticating that a large number will soon be following their lead; and I anticipate in the movement a wide field and a prosperous future for the gas industry. Since the foregoing was drafted, the Government have brought forward their Gas (Standard of Calorific Power) Bill to authorize undertakings to substitute a standard of calorific value for that of illuminating power. This has been passed into law, and it only remains for gas concerns to make application to the appropriate Government department to obtain the necessary authority for substitution.

NAPHTHALENE IN DISTRIBUTORY SYSTEM.

The toluol plant at Granton having been put to work in October, 1915, it was not long before we were experiencing trouble in the distributing system, through deposits of naphthalene due to the lower quality of the gas consequent upon the removal of the hydrocarbons; and as the carburetting arrangements were not completed, we were permitted at the outset to return into the gas the benzol which was extracted. This helped matters to a certain extent; but it was also deemed advisable to introduce a percentage of carburetted water gas, to assist in keeping-down the nuisance. I understand we were not alone in this experience, and at other works where the toluol plant was in use similar troubles had arisen.

As the public were suffering great inconvenience, and were then unaware of the important work being carried out in the gas-works in connection with the prosecution of the war, it was thought judicious to issue a notice on the subject; and in December, 1915, the local papers printed a memorandum entitled "Gas Supply and High Explosives—Effect of Government Demands." We sent out copies of this in pamphlet form to all consumers from whom we received complaints; and it is only fair to say the public were most forebearing and sympathetic towards us, and suffered the annoyance with a great amount of patience when they learned of the good work which was being performed.

Towards the middle of January of this year, when those in authority realized the important assistance which the gas industry could provide in relation to high explosives, the Ministry of Munitions were agreeable to the publication in all the principal daily papers of an appeal to consumers to increase the consumption of gas as much as possible and to substitute gas as a fuel in place of coal, so that more coal might be available for carbonization, and thereby add to the quantity of explosive products for shells, grenades, &c.

In connection with the naphthalene stoppages, it may be of interest to relate how these were dealt with. We found at the beginning that, on pouring a small quantity of methylated spirits into the service pipe through the "key-holes" of stopcocks or at special T-pieces which had been left for future use, the deposit, if of small amount, was very quickly removed. We discovered in many cases that the deposit speedily gathered again; and in these instances it became necessary to open-up the ground, cut the pipe, and clean it out with a wire—sometimes even resorting to washing-out with boiling water. A few of the mains of small diameter, where branches were taken off at right angles, became choked; and these had to be exposed and thoroughly cleared with rods and petrol.

Owing to the high price of methylated spirits and the difficulty of obtaining benzol, we soon turned our attention to petrol for dissolving-out the naphthalene deposit. Prior to the introduction of the new process, we in Edinburgh had been quite free from naphthalene troubles, due no doubt to the high illuminating value of the gas sent out (approximately 17 candles). We had therefore to organize a squad of men whose sole duty it was to deal with this nuisance. The Government, when the difficulty was pointed out, agreed to bear the expense incurred on this account.

CUTTING-OFF THE SUPPLY OF GAS.

The whole question of dealing with the gas supply in the event of bombardment or air-raids received the careful consideration of the gas officials in conjunction with the Military and Police authorities. The first idea of the Military authorities was that, should such danger threaten, the gas should be at once cut off at the works. In the case of small towns and villages, where the consumers are few and easily reached, not much difficulty was anticipated; but when we come to the larger towns and cities, where the distribution is effected from a number of centres and where there are many district governors controlling the pressures to various parts, and the consumers mount up to hundreds of thousands, a much more serious problem had to be faced. Again, when one weighed-up the amount of damage which might be done by a few shells or bombs dropped here and there throughout the area, and considered the grave danger to life and property which might ensue from the severance of the gas supply, it was deemed wiser to provide for the former contingency by organizing a gang or gangs of men who, at a given signal, would repair to a central station or stations, where suitable tools and materials would be provided to cope with any incidents which might arise, and who could turn off the gas, by means of the stopcocks or valves attached to the services and placed in the footpath, from any buildings which had been destroyed or interfered with.

To detail a few of the risks associated with the discontinuance of the supply of gas, I might mention that many taps and bye-passes would be sure to be left open, and when the normal supply was restored there would be great likelihood of explosions occurring and serious risk of poisoning, with consequent loss of life and destruction of property. The sudden severance of the supply, and the plunging of the whole town in darkness, would almost assuredly cause panic and other complications, when it is borne in mind the many hospitals, public institutions, theatres, picture houses, &c., where gas is consumed in large towns. It has also to be remembered that any trouble likely to take place from the enemy would probably only last for a short period—say, half-an-hour or an hour—and that if the gas were shut off at night it could not safely be restored until the following morning was well advanced. Consideration had also to be given to the munition works utilizing gas for war purposes, and the loss which which might be sustained by the interruption, as well as by the deterioration of the plant. On the other hand, a few shells or bombs might destroy portions of the manufacturing plant or the distributing mains, services, fittings, &c.; but men could be immediately despatched to cope with these isolated cases.

I had personally several interviews and lengthened correspondence with the Military, Police, and Municipal officials on this subject, and, at length, the following proposal was decided upon—viz., that the gas supply should not be withdrawn, but that all street-lamps should be extinguished and householders and others warned to completely darken their premises by shutting off the gas at the meter and seeing that all jets were properly turned off. In discussing this matter, the question of the public lamps, of which there are over 12,000 in our area, had to be taken into account; and as there are no means of automatically extinguishing these, and it would probably take a considerable amount of time to collect the men together and have all the lights put out, there was no other course open but to cease lighting the lamps. This system has been in force for about eighteen months, with the consequent reduction in the quantity of gas consumed.

Not long after the adoption of this course, the regulations relating to restricted lighting came into force in this district; and we have now only a few public lamps in use—such as those on the platforms at tramway stopping places, dangerous street corners, &c. This arrangement has brought forward again the subject of automatic lighting and extinguishing of the public lamps, and we are at present experimenting with a number of controllers in some of the districts. This, to many of you, may seem a simple matter; but, owing to the great differences in level prevailing throughout Edinburgh, and the fact that the pressures are controlled by means of thirty governors all worked separately and independently, some of which are supplied with gas direct from the holders and others are branched-off the trunk mains through which the gas is pumped from Granton, you will realize that the problem is surrounded with many difficulties. I have no doubt that these will all be gradually overcome. There were likewise the public stair lights to be dealt with, more especially those in buildings with glass cupolas, where the lights could be seen from above. To get over this difficulty, it was determined to remove all the burners on the top flats and plug-up the pipes. This meant a further falling off in consumption, as there were about 4000 of such lights.

AIR-RAID WARNING.

After some of the east coast towns had been raided by aircraft, it was decided that consumers of gas should in future receive some prior warning similar to that given to users of electricity, and which is accomplished by lowering the lights, and in some cases the total extinction of them. The matter was of such importance that we were forced to carry out experiments to ascertain just how far the pressure in the mains could be reduced with safety, so as to visibly affect the lights throughout the town and give the inhabitants warning. For this purpose a trial was made, last April, by suddenly reducing the pressure given out at all the governors by about 10-10ths. The result of the test was felt in a few of the districts, while others—chiefly those in the higher levels—were not affected. However, it showed us that the distribution of the gas was evenly balanced, and that the governing devices were all in good working order.

A second test was instituted a few days later, when the re-

duction in pressure was carried to a lower degree, by taking off from 15 to 20 10ths from each of the controlling apparatus. The outcome of this was considered satisfactory, as, previous to the trials, public intimation was given, and a request made that consumers might communicate their experiences to the Commissioners. Many replies were sent in, from which it was concluded that the warning would be effective to the large majority of consumers, although several intimated that the lights had gone out, and in other cases no appreciable difference had been observed. In following these up, it was discovered that, in the former, some local defect existed, and, in the latter, that a large quantity of gas was being wasted, and that when the pressure was taken down, the supply of gas to the burners was only reduced to what it should have been normally. It was therefore resolved that, when instructions are received as to the approach of aircraft, the pressure of gas is to be reduced, as indicated, at all the governing stations; and the public have been advised that when this occurs all lights are to be extinguished, as the regulations with regard to restriction and shading of lights will be rigorously enforced.

In arriving at the foregoing conclusions, we have taken care not to diminish the pressure of gas in any of the mains below the statutory amount fixed by Act of Parliament—viz., 8-10ths inch. It would be unfair to pass from this topic without complimenting the Technical Press on the energy displayed in promptly bringing before the notice of the Military authorities the risks and dangers attendant on the withdrawal of the supply; and I understand the War Office duly acknowledged the information, and took steps to circulate it throughout the various commands.

COAL AND RESIDUAL PRODUCTS.

I shall now direct your attention to the question of coal supplies and residual products; for, like the poor, they are always with us. No sooner had the war got well under way than the difficulties connected with proper supplies of coal, both for gas-works and domestic purposes, began to show themselves, owing to the large numbers of miners called up for service and to others volunteering. This trouble was partly compensated for by the restrictions on coal for shipment, retaining more for home use, and was also mitigated as time went on and the enemy started torpedoing merchant vessels, causing a feeling of uncertainty in shipping circles. As things became more acute, the Legislature conceived the idea of introducing the Price of Coal (Limitation) Act, 1915, as a panacea for the evil; and it had a rapid transit through the House of Commons, and, I fear without any adequate consideration, passed into law. To a certain extent it will be admitted that the Act has done good in modifying prices—at any rate, it has protected gas managers by placing them beyond the possibility of being accused of having made a bad bargain in the purchase of coal, by taking from them the power of negotiating prices with merchants. As far as we ourselves are concerned, and to enable us to proceed with business, we have come to a tentative arrangement with suppliers of coal bought by us, and whose contracts were in currency prior to the date of the application of the Act. Therefore, the final price to be paid for our coal is still subject to adjustment.

I observe, from records which have passed through my hands regarding the troubles experienced in relation to coal deliveries, that we in Edinburgh have not been subject to the extreme straits which many of our friends have passed through. One of the reasons for this is the fact that my Commissioners were sufficiently farsighted as to become proprietors of their own railway waggons, of which they own 212, of a capacity from 10 to 12 tons each. During the past twelve months these waggons have transported 60,000 tons of coal to our works. This quantity is equal to one-third of the total amount carbonized. I think I am right in asserting that if we had been without the monopoly of these waggons our supplies would have been short to the extent of the tonnage so carried. Their ownership has eliminated those irritating charges imposed by the railway companies from time to time under the heading of "demurrage;" and we are consequently in a position to gather sufficient coal in trucks to carry us over the week-ends without incurring any expense of the above nature. In order to raise the earning capacity of the waggons to as high a point as possible, we invariably send them out loaded with coke, so directed that, when emptied, they will reach the nearest colliery in the least possible time. In this way, coke and breeze have been carried to the extent of 20,000 tons, or 40 per cent. of our total annual sales.

Apart from the advantages I have detailed, the financial aspect of this question is an important one. These 212 waggons have cost the Commissioners £15,000. Repairs, maintenance, and running costs work out at £350 per annum; and adding 5 per cent. for depreciation, or £750, an outlay of £1100 per annum in all is shown. The actual earnings of the waggons amounted to £1780; leaving a surplus of £680, which is equal to 4½ per cent. on the capital cost. Whether in war or peace, I would confidently recommend to the serious consideration of every gas engineer who has reasonable railway siding accommodation the benefit of owning suitable waggons capable of carrying up to at least one-third of his annual needs.

It will have been noticed that the Board of Trade have arranged for the "pooling" of railway waggons; but I think they have come to a wise decision in excluding private owners' waggons from this scheme, in view of the many difficulties which surround such a problem, and the doubts as to whether any national benefit would be gained in the present circumstances, which require the fulfilment of so many coal contracts depending upon the retention of the means of transport which contractors and others, by their foresight, have provided, and in which so much of their capital is invested.

In addition to the increased cost of coal, the price of oil falls to be considered by those of us who have recourse to the assistance of carburetted water gas. Here, once more, we were confronted with Government control; the oil companies declaring that we could only obtain such surplus of their output as was available after Government requirements had been met. To these items of fuel there still remains to be added the additional charges for various materials used in our daily operations, such as iron and steel, brass goods, meters, fire bricks and clay, timber, oils, paints, &c. In order to provide for these, as well as for the labour already mentioned, the only resort was to raise the price of gas, which has been generally done throughout the United Kingdom. However, as in nature, so I believe in trade, there are compensations to be found assisting to maintain the "law of average;" and in the prices received for residual products we are thankful to be able to record valuable financial assistance on the revenue side.

I have prepared a short statement showing our relative return from coke, tar, and sulphate of ammonia as compared with the prices paid for coal. I have taken the five years immediately preceding the outbreak of war, and have averaged these and put alongside the comparative figures for the two years of the war.

From the figures [below] it will be gathered that, through various fluctuations, due to causes which need not be enumerated here, the average price of coal during the five pre-war years was 11s. 1d. per ton, and we got back from residual products, after debiting them with working expenses and cost of reagents, 8s. 2d. per ton, equivalent to 74 per cent. of the value of the coal carbonized. The year 1914-15 may be set aside as an abnormal one; but passing on to last year, when the advance in the coal rate was 4s. 2d. per ton as compared with the average of the previous five years, our residuals have yielded 10s. 4d. per ton—a rise of 2s. 2d., which is equal to 68 per cent. of the original cost. This proportion is only slightly below the average of the five pre-war years. With the dearer cost of coal, and residual products earning the same percentage return as in previous years, it does not follow that the net expenditure will be in similar relationship. The difference between the price of coal and the amount received for residuals has necessarily widened.

It is pleasant to note the fact that the product over which we exercise the most direct control—viz., coke—has been of the greatest service to us as a revenue earner; and, as I have expressed on a former occasion, the price of this fuel should be governed, within limits, by the amount paid for coal. This policy I have endeavoured to follow as closely as possible.

It is a matter of regret to those who sell tar direct from their works that the remuneration for this commodity has fallen considerably, solely accounted for by the principal outlet for pitch—

Statement showing the Average Cost of the Coal Carbonized at the Granton Works and the Values Received for the Residual Products, 1909 to 1916.

——	1909-10.		1910-11.		1911-12.		1912-13.		1913-14.		Average of Five Pre-War Years.		1914-15.		1915-16.	
Average price of coal per ton	10s.		10s. 4d.		10s. 4d.		11s. 1d.		13s. 6d.		11s. 1d.		12s. 9d.		15s. 3d.	
Received for residual products.	Per Ton of Coal.	Value Stated at per Cent. of Cost of Coal.	Per Ton of Coal.	Value as per Cent. of Cost of Coal.	Per Ton of Coal.	Value as per Cent. of Cost of Coal.	Per Ton of Coal.	Value as per Cent. of Cost of Coal.	Per Ton of Coal.	Value as per Cent. of Cost of Coal.	Per Ton of Coal.	Value as per Cent. of Cost of Coal.	Per Ton of Coal.	Value as per Cent. of Cost of Coal.	Per Ton of Coal.	Value as per Cent. of Cost of Coal.
	s. d.		s. d.		s. d		s. d.		s d.		s. d.		s. d		s. d.	
Coke	3 5	34	3 4	32	3 6	34	4 9	43	3 10	28	3 9	34	3 3	25	5 9	38
Tar	1 3	13	1 5	13	1 10	18	2 3	20	2 2	16	1 10	17	1 8	13	1 6	10
Sulphate of ammonia . .	2 3	22	2 7	25	2 11	28	2 10	26	2 5	18	2 7	23	2 6	20	3 1	20
Total	6 11	69	7 4	70	8 3	80	9 10	89	8 5	62	8 2	74	7 5	58	10 4	68

viz., export—having entirely closed. For those of us who are their own distillers of tar, I trust a good time is in store financially, as I quite expect that their accumulated stocks of pitch will come in for attention later on.

Sulphate of ammonia has assisted us from a revenue-earning point of view, although it is questionable if the price realized might not have been even more favourable had there been less control. In August, 1914, the export value of this product was practically £9 15s. per ton net and naked at works. Since October, 1914, a steady rise in this fertilizer can be traced up to the time when Government intervened with restrictions over both shipment and land sales. This came into operation at the beginning of the present year, when, to encourage the use of sulphate as a home fertilizer, and with the view of securing augmented crops within our own country, a standard price of £16 per ton net and naked was arranged for sale to manure merchants, with an increase of 10s. per ton if the transaction were made direct with farmers—the makers to supply bags. A percentage of our monthly make was to be put aside for this purpose.

A new arrangement has recently been arrived at with regard to the disposal of sulphate of ammonia for the coming autumn and spring seasons. A general meeting of sulphate of ammonia manufacturers was held in London on July 25, at which the Right Honourable F. D. Acland, M.P., Secretary to the Board of Agriculture, delivered an address strongly emphasizing the necessity, from the national point of view, of encouraging merchants and mixers to sell and farmers to purchase. At this conference it was unanimously decided to fix the price to merchants at £15 per ton and to farmers at £15 10s., in order to stimulate users to take early delivery. Special reduced prices of £14 10s. per ton to mixers and £15 to farmers were fixed for quantities removed from works between Aug. 1 and Sept. 30, 1916.

From our own experience and that of others, I cannot say that the desire of the Government was enthusiastically adopted by our agricultural friends; some of them preferring to fertilize with mixtures of artificial manures prepared by manufacturers, others adhering to the Chilian product, nitrate.

Latest advices from Frankfort, in Germany, report an enormous increase in the output of sulphate of ammonia, where the synthetic process, under the direction of Professor Haber, is rapidly progressing—in fact, it is no secret that the Badische Company have lately been erecting large installations in various parts of Germany. On the other hand, the Germans, with an adaptability unequalled by any other nation, have made wide use of this product to help their food supply—a system which we might advantageously put into practice. As no nitrate is available, they are reported as using up their entire output of sulphate of ammonia within their own domain. It is said the synthetic process can place nitrogen, in the form of sulphate of ammonia, on the market at £8 per ton; so that a serious loss of revenue may be anticipated if manufacturers in this country are to compete in the world's markets against the output from this process. This figure must be received with caution, as actual statistics are not meantime forthcoming.

Those who work up their ammoniacal liquor into sulphate of ammonia were subjected to further control by the price to be paid for sulphuric acid being fixed at £3 15s. per ton, owing to the enormous requirements of the Government and the difficulties of obtaining shipments of pyrites ores. We have been able to secure supplies of sulphuric acid at a much lower figure by negotiating with our contractors to take over our production of spent oxide of iron. When we keep in mind that 100 tons of spent oxide of iron, having a sulphur content of from 45 to 50 per cent. in the wet, contain an equivalent of sulphur capable of producing 160 tons of 144° sulphuric acid, the value of this spent material will be readily understood.

DAY-LIGHT SAVING.

So much has been said on this subject already that it is not my intention to take up more than a few minutes with it, and I shall only say a word or two as to the way in which the scheme has affected ourselves. Immediately prior to the Act coming into force, representatives of the daily papers waited upon me to ascertain what I thought the probable effects would be. I then pointed out that the reduction would only be likely to affect the amount of gas used for lighting; and as the proposal was to operate during the summer months, when only about 30 per cent. of the total gas sent out was consumed, I considered that on the whole year's consumption the loss would in all probability come to about 3 per cent., which, nevertheless, represents the somewhat substantial figure of about £10,000. Now that we have had three months' experience of the system, I find that our original figure has been near the mark; so it behoves us to do all we can to increase the amount of gas consumed, with the object of recovering as much as possible of "distilled products" for high explosives. We are therefore endeavouring to encourage the use of gas throughout the day for heating, cooking, and motive purposes, as it is only by these means that we can hope to make good the deficit.

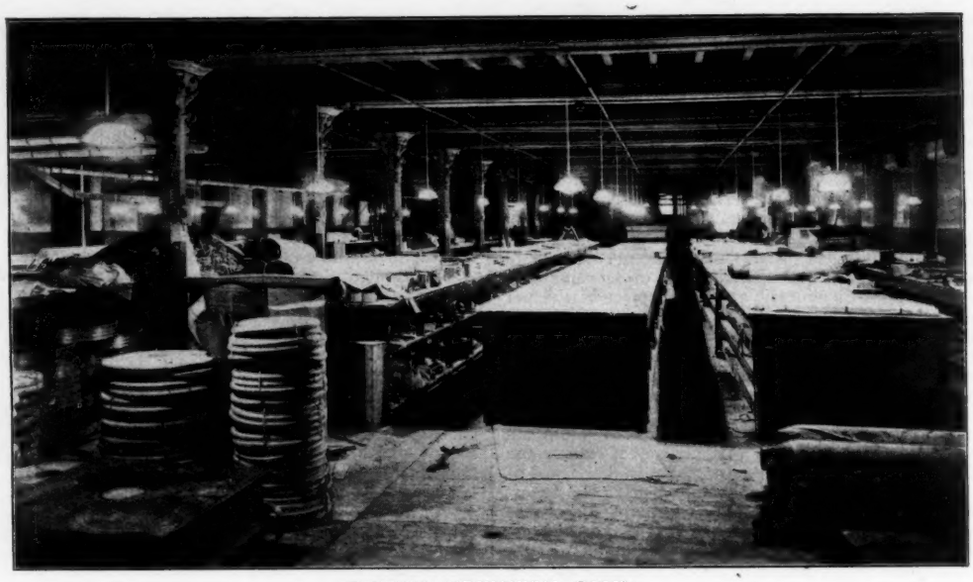
DEVELOPMENTS IN HIGH-PRESSURE LIGHTING.

I am pleased to be in the fortunate position of being able to bring before your notice a highly interesting and, to my mind, a far-reaching development in connection with high-pressure gas, having special reference to the lighting of factories, workshops, &c. By the courtesy and the assistance of the James Keith and Blackman Company, Limited, of London, the patentees, I am enabled to give you a full description of the plant, and to provide illustrations and photographs of this, and also to show the illuminating effects.* I shall preface my remarks by explaining that we have in our area a large factory belonging to the North British Rubber Company. For many years these works have been lighted by gas on the low-pressure system; and some time ago we were called in to recommend an up-to-date and economical arrangement of incandescent lights. After numerous experiments, and with the object of reducing the consumption to a minimum consistent with efficiency, the Star burner, regulated to consume approximately 2¾ cubic feet of gas per hour and yielding a light of about 80 candles, was adopted. This proved satisfactory for a time; but it was felt that, with the keen competition of the electric light and the concessions which that department was prepared to offer to secure the business, a strong effort should be made on our part to have the high-pressure system installed, in view of the considerable extensions which the Rubber Company had in contemplation.

After negotiations with the representatives of the Company, it was decided that one of the new buildings should be divided up—one half of each floor being lighted by electricity and the adjoining half by high-pressure gas. The outcome of this trial was to guide the management in determining the method of lighting to be applied throughout the additional extensions and, possibly, in the old works. We therefore fitted up a high-pressure gas-plant, with compressors in duplicate, driven by electric motors (there being a good supply of electricity in the works); the lamps being chiefly of 80-candle power, consuming from 1½ to 1¾ cubic feet of gas per hour. We undertook to curtail the amount of gas burned as

* An illustration of the arrangement here referred to appears on p. 437 of to-day's "JOURNAL."—ED. J.G.L.

INDIA-RUBBER BOTTLE-MAKING DEPARTMENT.



GENERAL MECHANICAL ROOM.

compared with the low-pressure burners by about 40 per cent.; and we have accomplished this part of the bargain.

The lamps were of the ordinary high-pressure type, fitted with enamelled reflectors and glass globes having a central opening at the bottom and kept in position by wire clips. The effect was quite good. However, as you will understand, in a rubber factory with so much inflammable material about, insurance restrictions are fairly severe, and naked lights are banned. We had consequently to look for a method of lighting which, while not exposing a naked light, would also, through usage, not damage the mantles and glass. For this purpose, the question of bye-passes was first considered; but taking into account the small consumption of the burners, it was seen that the bye-passes, going continuously, would consume in the course of the year practically as much gas as the burner. This idea was therefore discarded; and as we had discovered that the workmen (who had been in the habit of using a taper) had blackened the globes and in many instances destroyed the mantles, followed frequently by the cracking of the globes when the high-pressure gas impinged upon them, we made up an electric torch somewhat on the lines of the "Telephos," and consisting of a battery with a long igniter and push-button. This worked fairly well; but the cost was rather high, and the igniter had to be held pretty close up to the mantle to ensure lighting. In this way, many mantles were broken.

These troubles, combined with the dusty atmosphere which is prevalent in many portions of a rubber works, set the James Keith and Blackman Company (who had experienced the same things in other places) thinking on different lines, with the result that they brought out what they have named their "Duct" system. In this, a special box conveying fresh air from the outside is led through the building, and the high-pressure gas is coupled-up at various points in its length, each of these connections supplying, by means of one injector, a number of high-pressure burners—four, six, or eight as the case may be. The injector is therefore of large capacity, and not liable to choke. It draws in the correct quantity of fresh air from the duct; the mixture of gas and air being forced along a pipe ¾ inch or 1 inch in diameter, to which the burners are attached in the required positions. These burners consist of a flexible down-tube to compensate for vibration, with a heating chamber, at the foot to which the nozzle is fixed on the lower side, and on which, in turn, the mantle is screwed. Small square opal reflectors, in four pieces, are fitted immediately above this, to throw the light down on the tables or machines. There is no globe of any kind; but about 2 inches beneath the mantle is hung a small round wire gauze, to intercept either the ash or the mantle rings should they fall off.

The consumption of gas is 1½ cubic feet per hour; and the candle-power from 75 to 80. The distribution of the light is excellent; the opal reflectors allowing a certain amount of illumination to pass through, giving the workshops a bright appearance all over. As the "Ducts" were not needed in all parts of the works, but only where dust was met with, the makers provided a further adaptation, connecting the injectors from the high-pressure pipe direct into the tube supplying the rows of burners—these injectors drawing in their air from the atmosphere of the room. We have thus been able to bring down by 40 per cent. the amount of gas burned. The installation has not been long enough in operation to give you figures relating to the maintenance, although I am assured that it is much below what was taken in the first instance, and sufficiently small to bring the cost well below that of electricity. I may add that the type of burner and fitment has been passed by the insurance companies; and the installation has given such satisfaction, and so far exceeded the expectations of the superintendent, that we have been authorized to proceed with a number of other extensions in the works. I feel confident in prognosticating that there is a wide field for this type of high-pressure lighting, and it lies with ourselves to give it the greatest possible publicity and bring it to the knowledge of factory and workshop owners in order to secure its adoption.

Recognizing the importance of a thoroughly reliable lighter which would meet with the requirements of the Company and the insurance agents, Mr. Keith has been experimenting in this direction, and has at last evolved what may be considered so far the "acme of perfection."

The important points in connection with the "Duct" system and its advantages over existing methods may be briefly summarized as under:

(1) The new "Duct" system may be applied in lighting factories under normal conditions—the air being drawn in from the room, or in dusty places special "Ducts" fitted to lead the air from the outside.
(2) The lamps, having no nipples or air adjusters, chokages are entirely obviated, and the consumption can be brought down to one cubic foot of gas per hour or even less. The effect of this on the maintenance is appreciable.
(3) These small units render the system useful in competing with the electric light as regards candle power and cost.
(4) With the new fitting, globes are not needed, and the consequent saving in upkeep is important. In specially dangerous positions, however, a wire gauze can be fixed to catch any mantle ash or broken rings which may happen to fall off.

Conclusion.

Now, I have come to the close of my address. As I meant it to be a record of what has taken place during the time we have been at war, I could not very well condense it without omitting certain events and facts all of which are important enough to be chronicled. I hope that some at least of the points touched upon may be of use to you in your future careers.

Mr. John Lang (Alexandria) called for a vote of thanks to the President for his address. It was a long address; but while it was so, it was a valuable record of what had been done during the war. It would prove distinctly interesting to all after the war was over. Mr. Masterton's case was typical of what was happening at gas-works all over the country, although some of the circumstances might be a little different. In his (Mr. Lang's) own district the circumstances called for a good deal of energy, owing to an increased consumption of gas occasioned by the presence of munition works. At the present time his consumption was quite 100 per cent. higher than it was last year. Probably many present would welcome a situation such as this; but he himself would be quite glad to get rid of it.

The President, in acknowledging the vote of thanks, expressed the hope that his address would prove useful and helpful to the members. It was rather a difficult matter to find new subjects on which to descant, more especially under present conditions, when their thoughts and energies were absorbed by the demands which this hateful war was entailing upon them.

Papers and Discussions.

The following papers were thereafter read: "Corrosion in Steel Gasholder Tank," by Mr. William Wilson, of Falkirk; "Gas Authorities as Suppliers of Electricity, with a Description of Producer Gas Generating Plant at Alloa," by Mr. J. W. Napier, of Alloa; "Gas-Furnaces and their Utility," by Mr. Ralph Halkett, of Glasgow.

New President and Officials.

It was intimated that the office-bearers for the ensuing year had been elected as follows:

President: Mr. John Lang, of Alexandria.
Vice-Presidents: Mr. Wm. Wilson, of Falkirk, and Mr. Robert Muir, of Galston.
Councillors: Mr. J. W. Napier, of Alloa, and Mr. Charles Fairweather, of Kilmarnock.

The President congratulated the members on the happy choice of officials.

Mr. John Lang, the President-Elect, returned thanks for the honour which had been conferred upon him in being elected President. He felt it a great honour to be President of what was possibly the oldest Association of its kind in Scotland. He hoped he was correct in saying the "oldest," and that members of the Waverley Association might not find fault with him for the observation. He could assure them he would do all in his power to maintain the high standard of efficiency and courtesy set by previous Presidents of the Association.

Votes of Thanks.

Votes of thanks were awarded the Scrutineers, the authors of papers, and the Secretary (Mr. P. B. Watson, of Wishaw).

Presentation of President's Medal.

Mr. J. B. Scott (Cowdenbeath), in the course of a few felicitous remarks, presented the retiring President with the gold medal of the Association. He hoped Mr. Masterton would accept it as a souvenir of an interesting meeting, and that he would have pleasure in wearing it for many years to come.

The President said he would value the gift as a souvenir of duties which, during the year, had been neither onerous nor difficult, but exceedingly pleasant. He confessed that he vacated the chair with a tinge of regret; but the feeling of sadness was quickly dispelled when he remembered that he was to have such a valuable and efficient successor as Mr. Lang. He thanked them all for their kindness to him during the year; and he trusted the usefulness of the Association would be increased, and its borders enlarged, in the years to come.

The meeting concluded with the singing of the National Anthem.

Pit-Head Conversion of Coal.

In an editorial note on the subject of coal, in the August issue of the "Transactions of the Society of Engineers," it is remarked that, of the methods proposed for economizing coal, the most popular is to convert it at the pit-head into gas, using this to drive gas-engines generating high-tension electricity, and recovering the bye-products during the production of the gas. The bye-products form a very important feature of the conversion, in addition to the much higher thermal efficiency of gas-engines than steam-engines. Thus far there is little to object to in the proposals. In fact, there are immense advantages in them. But there remains the question of the production of heat; for while electricity is admirable as a means of distributing light and power, it is distinctly uneconomical for producing heat. Its very efficiency as a light-producer indicates its inefficiency as a heat-producer. The price of electricity might, by the foregoing method, be reduced to less than ½d. per unit; but whatever the price, to re-convert electricity into heat is unsound from a thermodynamic point of view. Hence we must be prepared to distribute some of the gas from the pit-head, and use that for cooking and heating. The higher the price of coal, the more advantageous such a scheme would be. Now, our coal costs us 67 per cent. more than the United States coal costs the Americans. Therefore it is all the more necessary for us to adopt methods of coal economy; otherwise how can we expect to compete in the open markets with a country which has to pay for coal—the life-blood of engineering—only 60 per cent. of what we pay for it, especially as, in addition to the low price, America is now producing vastly more coal than we are? The cheapness of American coal is all the more significant when it is remembered that practically everything over there is much dearer than here; so that relatively their coal costs them even less than 60 per cent. of what ours costs us.

An American Pipe-Joint.—A new type of joint has been developed and patented by the American Cast-Iron Pipe Company, of Birmingham (Ala.), which, it is claimed, not only makes a saving of 50 per cent. in the amount of lead required, but at the same time gives a much improved joint. The device consists of a string of cast-iron wedges, each tapered at the ends, cast on a steel wire, properly designed to fill the space, while allowing for slight imperfections in the bells or spigots, or for deflections in the line. A small quantity of jute is driven into the joint in the usual way, and then the wedge filler is inserted, followed by more jute, which forces the filler over into the lead ring. Finally, the lead is poured and caulked as in ordinary practice. The wedge affords a foundation against which to caulk the lead, making it possible to drive it into the lead ring with less labour. When the pressure comes on the lead, either from the ordinary pressure or from the pipe-joint settling, the face of the wedge forces the lead over against the pipe and up to the lead ring, making the joint tighter. In other words, the stronger the pressure, exerted from the inside to force the lead out, the tighter the joint will become.

GAS-FURNACES AND THEIR UTILITY.

By Ralph Halkett, of Glasgow.

[A Paper read before the North British Association of Gas Managers.]

It is impossible, in a short paper, to do complete justice to the subject which I have chosen as one likely to be of interest to you to-day. Therefore, though it is impossible to entirely omit some generalities, I will endeavour to give you, as concisely as possible, facts and experiences we have had in Glasgow with reference to gas-furnaces.

As a fertile field for consumption, it was early recognized that the study of furnace heating by means of town's gas was both profitable and progressive; and in 1913 a room at the Milan Street workshops was specially equipped as a gas-furnace demonstration room, with most excellent results. A three-fold purpose has been served: Firstly, certain furnaces are permanently installed, and representatives of makers are at liberty to send, or bring, any prospective purchaser to see the furnace of their choice under actual working conditions; and there are also arrangements by which the makers can fit up any other class of furnace not already installed, for the benefit of a sale. Secondly, the intending purchaser can directly benefit by seeing his class of work actually being performed, if he chooses to send the material required for the test. In both cases suitable notice must be given to the furnace expert, so that he may make the necessary preparations. A third purpose is served, as the furnace expert, having the furnaces, &c., under his control, can study and experiment and otherwise familiarize himself with the appliances, so that his knowledge will be of the greatest benefit when he is required to exercise it on the district in canvassing, advising, &c.

The Furnace Expert.

I think the occasion warrants a special word for the furnace expert, now that mention is made of him. Furnaces are different from any other appliance in the gas industry, and therefore furnace work calls for a specially trained man to guide and direct the business entailed. This is a distinct difficulty. I do not recommend that a man should be employed who has served with a furnace maker, for he would naturally have an inclination for the furnaces with which he was so familiar, if only because he knew their good points and shortcomings better than those of others, and felt he was safer in recommending them. It is essential that strict impartiality should be shown alike to all furnaces, and the purchaser have the opportunity of obtaining the very best in the market for his class of work.

To overcome this difficulty in Glasgow, we chose from our own staff a man who possessed the necessary qualifications, with the exception of a knowledge of furnaces. He possessed a practical mechanical training, was of good address, and had a keen interest in his business. At the expense of the department, he was sent to the various manufacturers; and it affords me much pleasure in saying how, with one accord, they all gave him a courteous reception, and every opportunity of acquiring a working and building knowledge of their furnaces, besides anything that was of interest to him and to them that he should know. He also took up various branches of study bearing upon furnace work, and the many manufacturing processes to which they were adaptable; and the demonstration room was an invaluable asset to him. When canvassing the district, the knowledge thus gained was of great advantage; and at the same time the man was enabled to utilize opportunities, direct and indirect, afforded him of acquiring much other knowledge during his visits to the various workshops.

The furnace expert has to be a man of tact and discretion. It necessarily follows from the nature of his business that he will often learn items of an extremely confidential nature; and he must remember not to divulge any of this information, while yet adapting his knowledge to suit the requirements of the case, and storing it in his mind as an aid to solve other cases that may arise. A summary of the study necessary to become competent as a fuel expert may be of some use to those who wish to specialize in this branch; and therefore I include the following list:

1.—The heat treatment of steel in all operations. (This is most important.)
2.—The melting of metals, such as copper, gunmetal, yellow brass, aluminium, and all low-temperature metals.
3.—Forging, including bolt and rivet making and heating.
4.—Plate heating, drop forging, and welding.
5.—Large ovens, for such work as enamelling, japanning, and cores.
6.—The firing and glazing of pottery.
7.—Annealing and enamelling of glass.
8.—Sugar boiling and allied operations in confectionery trade.
9.—The combustion of gas as applied to furnaces, when using town's pressure, high-pressure gas, and air-blast.
10.—The limits of temperature when using one or other of the above.
11.—The application of gas as a fuel in furnace construction, and the laws governing same, compared with other fuels.
12.—Flue draught, and its effect on the furnace.

This list might be further extended. The student himself will, however, be able to discover what will be beneficial in addition

to these, and he will certainly find that if he can make his own working drawings it will be a distinct advantage to him. Manufacturers are always ready and willing to help; but there are occasions when the fuel expert will find it a drawback not to have the required skill in sketching and drawing.

Equipment of the Demonstration Room.

The demonstration room in Glasgow will serve as an illustration of what is required in this way. It is large and well-ventilated; the lighting being subdued sufficiently to allow comfortable working, and it also allows for the better estimate of furnace heats as judged by colour. This is a practice which ought to be ruled out of use, yet many still cling to this method instead of using the pyrometer.

FURNACE DEMONSTRATION ROOM—GLASGOW CORPORATION GAS DISTRIBUTION DEPARTMENT.

The equipment consists of two gas and air compressing sets joined in duplicate, of the following capacities; One 10 H.P. gas-engine coupled direct to a compressor capable of delivering 10,000 cubic feet per hour, and one 5 H.P. gas-engine coupled direct to a compressor and delivering 5000 cubic feet per hour. Both sets are worked at a pressure varying from 1 lb. to 5 lbs. per square inch. All gas used in the room is supplied through a 4-inch service-pipe having a master tap. Between this tap and a 400-light dry meter are taken two supplies—one with a 60-light dry-meter fixed to supply the engines, the other to the inlet of a large compressor with a rotary meter fixed, which is employed when it is desired for gas. Being mostly used for air, it is seldom that the need arises, unless the volume required exceeds the capacity of the smaller set. All changes made from one plant to the other are done by operating rack-and-pinion valves; all gas being cut off entirely when the master tap is closed.

From the outlets of the meters and compressors there are carried 4-inch M.I. pipes running parallel and 6 inches apart, with wheel valves on each, and spaced at suitable distances. These are carried round the main wall and painted different colours to make them distinctive. They are also lettered to denote their contents, as follows: Low-pressure gas, high-pressure gas, high-pressure air. Pressure gauges are connected to each, and give readings in mercury and water-column pressures.

A number of furnaces are fixed permanently, but are subject to change when desired to a later design, as the advantage of being up-to-date is of the utmost importance. Special equipment is added as the need arises for carrying out experimental work and any special test that may occur for which there is no recognized apparatus to meet the case.

A portable pyrometer set is installed, capable of recording temperatures up to 1400° C., or 2550° Fahr. For temperatures above this, Seger cones are used. For running tests under working conditions with any type of furnace and for any particular process, the temperature factor has such an important bearing on the final result that to attempt to do without it is valuable time and material wasted. Its use guarantees absolute control and repetition in all operations performed, and is a direct check on gas consumption for any temperatures in any size of furnace.

Previous to the war, a considerable number of gas-furnaces were in use in Glasgow; and these have since been augmented by others specially installed in shipbuilding yards and for munition work. This fact has special significance, because in many cases gas has only been utilized when other methods have been tried and failed. For the production of shells and other ordnances of war, it is now generally admitted that gas-furnaces are particularly suitable. The chief points in favour of the working of these appliances are: The convenience, cleanliness, uniformity, and least oxidation (items of vital importance); also the gas, being consumed by perfect combustion, is confined in the space to be heated, and the waste heat which escapes from the vents is at a minimum and low in temperature. Accurate fuel costs can be obtained and a check kept on waste, which is impossible when using solid or liquid fuel. The distribution of heat is perfect. The temperatures are under absolute control, and can be so maintained for an indefinite period without attention. Although the fuel cost, therefore, may in some cases seem higher than other fuels, the advantages gained are very important, when the uniformity, the speed of operation, and the output are taken into consideration.

Points to be Observed.

No definite information can be given as to the actual gas consumption of any particular furnace, as several factors must be taken into consideration before any calculations can be made. For instance, the number of heat units contained in the gas varies in different localities. Again, the amount and nature of the work to be done must be considered, as every heat unit absorbed by the work in obtaining the degree of temperature required must be supplied by the gas, and its consumption is therefore proportionate to the work done. Much also depends upon the correct handling of the control valve, in order that the best results may be obtained at the least cost. Care needs to be exercised in recommending furnaces for the different classes of work—to see that they are the proper type and their application and utility suitable for the purposes required of them. In estimating the size of furnace required, it is necessary to take the over-all dimensions, length, breadth, and depth of boxes, pans, or work in bulk, and add 2 inches to each dimension. This is the smallest working space allowable.

In furnace construction, the application of gas as a fuel makes it possible to economize in floor space, as it can be applied direct to the working chamber without first passing through the combustion boxes and regenerative flues. This also considerably lessens the expense. The flue draught, having a direct effect on the efficiency of any furnace, must be so adjusted as to give sufficient pull that, on placing a lighted taper to the sight hole, the flame will be slightly drawn in. If by any means a fierce draught is created, the furnace will not attain a correct heat, owing to the quantity of cold air drawn in; and the gas consumption will be increased in the attempts to counteract these effects.

It is very often desired to convert existing plant to gas heating; and to do this the furnace expert will need to be familiar with the technics and terms as applied to the many processes using heat which the work may have to go through. It is also useful to have an intimate knowledge of all the apparatus used for the production of heat for immediate reference, together with constructional details of furnaces using solid, liquid, or gaseous fuels, and the units of each as applied.

It has been proved that a skilled mechanic can easily harden three dies in a gas-heated furnace to one in a coal or coke fire, and with far less trouble and anxiety. To understand this, it must

be recognized that the heat has to be very evenly distributed, so that the dies may be kept from overheating in spots. This necessitates careful manipulation of the fire, and, however careful the workman may be, he can never be absolutely sure that his die will be heated "just right." If the furnace be a gas-heated one, the temperature will be perfectly uniform all over, and he can work more speedily than with any other; and speed is a vital point.

Annealing is another process of vital importance in all classes of work, and so much depends upon how this is done that steel manufacturers are now emphatic in instructing users to utilize gas-furnaces for the heat treatment, no matter for what purpose the steel may be required.

Heat Treatment of Steel.

There are three systems of furnace heating by gas; but the method most successfully adopted is that of gas under normal pressure with air blast. Special processes, however, have their own particular requirements; and it may be of interest to deal briefly with some of these. For instance, the heat treatment of carbon steel covers several operations, as follows:

Carbon Steel.—Annealing requiring a temperature of 880° C.; case-hardening, 925° C.; hardening, 740° C.; tempering, 220° Fahr. upwards, and according to the purposes for which the articles are intended.

As will be noticed, all the temperatures mentioned are below 1000° C.; and assuming this as the maximum required at any time, the furnace most suitable would be a natural-draught oven. The dimensions would be decided by the amount of work that has to be done. As a guide, however, it may be mentioned that an oven measuring 36 in. by 24 in. by 12 in. high would be generally a convenient size, and capable of taking at least half a ton of work as its maximum load. The maximum gas consumption in a furnace of this description would be about 500 cubic feet per hour, and to maintain the maximum temperature 300 cubic feet per hour.

Natural-draught furnaces are efficient for temperatures up to 1000° C. (1832° Fahr.). Above this, it is advisable to use air-blast. In the furnace fitted with air-blast the recuperative powers are 25 per cent. better, with a corresponding increase in production, and a saving in gas. Added to this are the extra cost for blower, power, and piping; while the natural-draught furnace is independent of either, and can be run night and day without attention. The determining factor, however, in most cases must be that of temperature.

High-Speed Steel.—Another class of steel which is very much used in the manufacture of tools is high-speed steel. Such tools as milling cutters, taps, dies, reamers, twist drills, and cutting tools are nearly all made from this steel; and as it is one of the most difficult to harden, on account of its high hardening temperature (which is about 1260° C.), a special type of furnace is necessary to attain and maintain this high temperature, and no type of furnace can be relied upon to give the uniform results that a gas-fired one will give. In this case, gas with air-blast must be used, and the furnace must be provided with a pre-heating chamber; this chamber being heated by the waste gases from the lower, or high temperature, one. As these furnaces are made in various forms, the nature of the work will determine the type to be used. The most common types, however, are the twin ovens or muffles for taps, dies, and other similar work, and the crucible type for reamers and twist drills, which must be done vertically to prevent any warping.

Forging Bolt and Rivet Making.—The forging of bolts and rivets requires a fairly high temperature—about 1400° C. To obtain this, the furnace must be so constructed to suit the work for which it is intended. In the majority of cases, a modification of the "Glory Hole" furnace would meet the case, in so far that the front would be fitted with a suitable opening or series of holes. The weight and quantity of material it was desired to handle would decide the size of furnace required; but in a furnace measuring 9 in. by 9 in. by 6 in. deep, and consuming 300 cubic feet of gas per hour, 180 1-inch bolts can be heated and forged. This is equal to three bolts per minute at a cost of 7½d. per hour. with gas at 2s. 1d. per 1000 cubic feet, or 0·16d. per bolt.

Plate Heating.—The need for heating steel plates which require to be pressed into shape has led in some cases to the adoption of town's gas. With plates of small dimensions the results are both economical and satisfactory. For plates of larger dimensions, it is not always to be recommended with regard to cost unless there is a large amount of work to be done. In this instance, to successfully compete with other furnaces, gas would need to be supplied at from 10d. to 1s. per 1000 cubic feet. This would be quite possible on the sliding-scale of the amount of gas consumed. As an example of what can be done on a large scale, the following data will give some idea.

In a furnace measuring 10 ft. by 8 ft. by 2 ft. 3 in. high, and consuming 3500 cubic feet of gas per hour when working at the maximum, four hours would be required to heat to 1000° C.; thus consuming 14,000 cubic feet before any work can be done. Starting with plates measuring 5 ft. by 4 ft. by ⅝ in. thick, twenty plates can be done in 5½ hours; the average for each plate being only 16 minutes. The total weight of metal heated amounted to 10,920 lbs., and excluding that consumed in heating-up the furnace to a working temperature, the gas consumed equalled 2·115 cubic feet per pound of metal heated. The total consumption for the day's work was 55,300 cubic feet, which, at 1s. per 1000 cubic feet, would cost £2 15s. 3⅛d.—not a very costly item when the amount of work done is taken into account.

Spring-Making Furnaces.

Spring Making.—As an example of what can be done with gas-heated furnaces in a spring-making shop, take the following: An installation of seven furnaces was installed to replace fuel furnaces in the spring-making shop of Messrs. Thomson, Sterne, and Co. of Glasgow. The points of interest in this installation are many, but one or two might be quoted as specially so:

1.—The floor space gained is equal to two-thirds, which is fully demonstrated by comparing the old coal-furnace with the new gas-furnace on the right.
2.—The absence of smoke and soot in the workshop.
3.—The reliability and uniform temperature, which is essential in spring-making.
4.—The saving in labour in this instance—one stoker dispensed with.
5.—The fuel bill for coal-furnaces was £694 per annum.
6.—The gas consumption for seven furnaces per day amounts to 20,000 cubic feet, and for 300 working days at the above rate 6,000,000 cubic feet per annum. This works out at approximately £425 (the price of gas for industrial purposes), showing a saving in fuel alone of £269 per annum.
7.—The quality of the work is shown to be superior, owing to the uniform temperature obtained.

The above furnaces were installed in July, 1914, and proved so satisfactory that the firm decided to abandon the solid fuel altogether and use gas-furnaces. They now do the whole of their work with gas-furnaces. The firm lately installed a furnace for doing large springs, and also one for japanning purposes; making an additional consumption equal to 6000 cubic feet per day—now making, in all, 26,000 cubic feet of gas per day, or, for a yearly total of 300 working days, 7,800,000 cubic feet.

Metal Melting.—The melting of metals is done most successfully with gas-fired crucible furnaces; the type varying with the nature and quantity of metal, and the purpose for which it is to be used. The most common forms of furnaces used are the "tilting," capable of dealing with quantities of from 120 to 600 lbs., and the "stationary," in twin and single type, which will deal with quantities up to 200 lbs. Each and all of them can work with gas and air-blast at 2 lbs. pressure, or high-pressure gas at 12 to 15 lbs. pressure. Copper, gun-metal, yellow brass, aluminium, and many other metals of a similar nature can be melted in quantities of from 60 to 600 lbs.; the working costs being 3·5 cubic feet per pound of metal melted. Lower gas consumptions have been obtained; but the average given is for practical working.

The following are the results obtained from crucible furnace in melting brass:

First Heat from Cold.

Time.		Index.	Scrap Metal.	Loss.
hr.	min.			
2	2 ..	394,070 cubic feet	.. 60 lbs. yellow scrap	.. 2½ lbs.
3	20 ..	394,380 ,, ,,		
1	18 ..	310 cubic feet = 5·16 cubic feet per pound.		

Second Heat.

Time.		Index.	Scrap Metal.	Loss.
hr.	min.			
3	30 ..	394,380 cubic feet	.. 60 lbs. yellow brass	.. 2 lbs.
4	25 ..	394,590 ,, ,,		
0	55 ..	210 cubic feet = 3·5 cubic feet per pound.		

Third Heat.

Time.		Index.	Metal Ingots.	Loss.
hr.	min.			
4	35 ..	394,590 cubic feet	.. 60 lbs. yellow brass	.. 2 lbs.
5	22 ..	394,775 ,, ,,		
0	47 ..	185 cubic feet = 3·08 cubic feet per pound.		

The above three melts combined make a total of 180 lbs. of metal melted in 3 hours, for a gas consumption of 705 cubic feet, which works out at 3·9 cubic feet per pound of metal melted.

The following results are the average obtained under working conditions when using a 300-lb. tilting furnace fitted with air blast; the metals melted being copper, gun-metal, and yellow brass.

Average working period per day	= 10 hours.
,, number of melts of 300 lbs. each = 5 melts	= 25 cwt.
,, time for each melt	= 2 hours.
,, gas consumption per lb. of metal for casting	= 5 cubic feet.
,, gas consumption per lb. of metal for ingots	= 3·75 ,,
,, life of pots	= 35 heats.
,, ,, furnace	= 6 months.

It is considered that two tilter furnaces will do the work of six 150 lbs. coke-heated pit fires, and the working costs average about the same as the six coke fires; but gas has the usual advantages which are considered important.

Another set of figures has been given by a Glasgow firm—Messrs. Whyte Thomson and Co.—and shows a considerable saving in the working cost experienced by them in using gas for power and manufacturing purposes.

By the old system (using steam power and coke for furnaces melting brass and gunmetal):

One year's account for power	£75
,, ,, ,, coke (coke at 16s. per ton)	60
	£135

The average number of melts per day with coke = 4.

By the new system (using 34 H.P. gas-engine and crucible furnace)

One year's account for power	£49 14 6
,, ,, ,, furnace (gas at 1s. 6d. per 1000) manufacturing rate	55 4 0
	£104 18 6

The average number of melts per day with gas = 6.

Hence we see a saving effected of £30 1s. 6d., with a 50 per cent. additional output.

Gas in the Glass Industry.

The use of gas in the glass industry covers several operations and the principal types of furnaces used are as follows:

Annealing Glass.—Annealing furnaces are generally about 70 feet long, and are heated for about one-fourth of their total length; the remaining portion maintaining a graduated temperature from the waste heat in proportion to its length—the temperature in the hot portion being 900° C., and the gas consumption 1000 cubic feet per hour. The hot glass which has been blown or pressed into shape is transferred to what is termed the "Glory Hole," which is heated by gas and air blast to a very high temperature, in order to keep it sufficiently plastic for further treatment. It also serves to give a finished appearance by removing all friction marks due to pressing or otherwise. The article is finally transferred to the annealing oven to cool down slowly by passing through the entire length of same.

Enamelling Glassware.—This is done in specially built muffles. The size of these varies. The nature of the work and the amount will decide what the size should be; the average being capable of consuming 2500 cubic feet to complete a batch of glass.

The following data in regard to pottery kilns are also useful:

—	Coal.	Gas.
Size of kiln, inside dimensions of muffle	20 in. by 20 in. by 18 in.	18 in. by 18 in. by 24 in.
Biscuit firing— Time to reach 1100° C. from cold	12 hours	8 hours
Glaze firing— Time to reach 1050° C. from cold	10½ hours	7 hours
Fuel, &c., charges per load (biscuit firing)	Approx. 7 cwt. coal at 10½d. = 6/1½ Stoking . . 10/- 16/1½	350 cubic feet per hour = 2800 cubic feet at 2/1 per 1000 = 5/10
Breakage (due to irregular heating)	10 to 12 per cent.	*Nil.*

With coal the temperature of 1100° C. is very difficult to attain and maintain.

Maintenance.—The maintenance costs have no comparison, as the coal-fire kiln has to be re-built every six months, as against one muffle for gas.

Output.—It will be seen that the gas-fired kiln can be charged and fired the same day, as against two days required for coal. Thus with gas the output is doubled for the same cost.

It is possible to allow girls and others who have only had a month or six weeks' training to handle the gas-furnace themselves. When using coal this was impossible.

Welding Gas Cylinders.

The welding of gas-cylinders is being successfully done in a gas-fired furnace. The cylinders measure 3 ft. 6 in. long by 8 in. diameter by 3-16 in. thick. The ends are stamped from 5-16 inch mild steel plate; and it should be noted that the end and the cylinders are of different thicknesses, which makes the weld more difficult to do.

Number of hours worked per day	24
,, ,, cylinders done per day, average	110
,, ,, welds ,, ,, ,, ,,	220
Gas consumption per hour, 1000 cubic feet	= 24,000 feet per day
,, ,, ,, weld 109 ,, ,,	
Average number of welds passed	198
,, ,, ,, ,, rejected . 2	= 1 per cent.
,, cost of gas per weld, 2½d.	= 5d. per cylinder
,, ,, per cylinder for labour per hour	1·29s.
Averate total cost to finish each cylinder.	1s. 9d.

The above cylinders, after being welded, are subjected to a hydraulic pressure of 300 lbs. per square inch, and are hammered from end to end so that the slightest flaw would show. It indicates remarkably good results when the average number rejected is only 1 per cent.; but the furnace and the burner used are the secret of the success achieved with this process. It also proves conclusively that welding by means of town's gas is a simple matter, given a suitable burner and furnace.

Lead Press Heating.

An interesting case is the converting of the system of heating on a lead press, where the old system was oil fired and replaced by high-pressure gas. The press in question is used to cover electric cables of various diameters; and the following results were obtained when working with oil.

Quantity of lead in pot when starting cold	25 cwt.
Time to heat-up to working temperature of 400° C.	3 hours
Total working hours per day	14 ,,
Total gallons used per day	40 gallons
Cost per gallon	8d. per gallon
Labour charges for pumping into storage tank	12s. per week
Storage space required for oil	12 barrels
Total daily cost	£1 8s. 8d.
Average number of gallons of oil used per hour	2·85

Results Obtained when Using High-Pressure Gas at 3 Lbs. per Square Inch.

Quantity of lead in pot when starting cold	25 cwt.
Time to heat-up to working temperature of 400° C.	1 hr. 40 min.
Total working hours per day	14
Total gas consumed in cubic feet	5000
Cost per 1000 cubic feet	2s. 1d.
Labour charges	*Nil*
Storage space	*Nil*
Total daily cost for gas	10s. 5d.
Average gas consumption per hour	357 cubic feet

Points in Favour of Gas.

Total saving in time to heat up from cold	1 hr. 20 min.
,, fuel per day	18s. 3d.
,, labour charges per week	12s.
,, floor space	12 barrels

Combined with above are convenience, cleanliness, reliability, and constant fuel value.

The lead press since being converted has been run on one occasion for thirty hours without stopping. During this period 20 miles of cable of various diameters were covered with lead, in which time about 12 tons of lead were used. When running on the old system, it would have been necessary to keep the boilers and firemen on duty, owing to the necessity of having steam pressure to operate the oil injectors; and this would have increased the cost per yard of cable covered. This saving might be added to the reduced cost of manufacture as obtained with the new system; but as this is already at a substantial figure, we can afford to ignore it.

Gas-Boilers for Varnish Making.

Gas-boilers used in the making of varnishes are rapidly being installed in preference to coal-fired boilers, and have proved to be quicker and cheaper in doing the same amount of work. The results in one instance were as follows:

With coal fired the time taken was 6 hours, and the coal consumption was 2½ cwt.

With gas fired, the time taken was 2½ hours; and with a high-power burner consuming 150 cubic feet per hour, the total consumption was 375 cubic feet.

Therefore, the approximate cost was about 8½d. free of all labour charges, with the advantage of an increased production and absolute safety from fire, which is a vital factor in the manufacture of varnishes. In this cost, the item for coal alone was 11s. per ton. or 6½d. per cwt.

Temperature Recording.

This paper would be incomplete without reference to the different methods of recording the temperatures in each of the processes touched upon. The thermo electric pyrometers are the type most generally employed for recording the high temperatures used in industrial work. The outfit consists of the indicator, the thermocouple, and connecting leads, and can be had either portable or stationary as desired. This is a set to be recommended where only one furnace is used, and where several may be located at different portions of the building.

In munition works, there are batteries of furnaces, and without the use of switches or surplus connections, it is possible to get a correct reading of at least four furnaces on one chart by introducing a thread recorder. Each furnace temperature is shown on the chart in different colours by a series of dots caused by a

lever depressing the thread on the chart every minute; the chart being graduated for time and temperature. In this way a permanent record is made and kept for future reference.

Some means of temperature control should be provided with every gas-furnace, no matter what type nor for what purpose it is desired, and most particularly where very high temperatures have to be obtained. Standard pyramid cones, which can be had up to 1860° C., are very useful in cases of high temperatures, and where doubts are likely to be raised. They also serve as a check on any pyrometer set, to prove the correctness of same.

Gas and Air Mixing.

The use of gas-furnaces has led to the introduction of other appliances, known as gas and air mixers, owing to the difficulty experienced in obtaining a proportionate mixture when gas was used at normal and air under pressure. Most of these "mixers," while improving the working of the furnace, still leave too much dependent upon the operator's skill and ability to adjust the air and gas valves so that they will give complete combustion at all times. Having found this to be detrimental, and being desirous of overcoming the difficulty, I have introduced a mixer: and so far the results have been all that could be desired. It has been in use on the district for some time, and we find that it has the following advantages: The gas and air valves are worked at full open, at all times. The gas and air are adjusted to accurate proportions by one simple operation. The adjustment can be re-set at a moment's notice, if necessary. The proportionate mixture, once set, remains constant. An intimate admixture, with perfect combustion is ensured. It gives an economical production of high temperatures. A small excess of gas will produce an effective reducing atmosphere. It can be used in melting all metals, and also for forging, annealing, and hardening. Nozzles and pipe connections are made by the users in any convenient way, to suit their requirements. Compressed air is required at pressures varying from 1 lb. per square inch upwards. The gas and air supply pipes and control valves must not be less than the connections on the mixer.

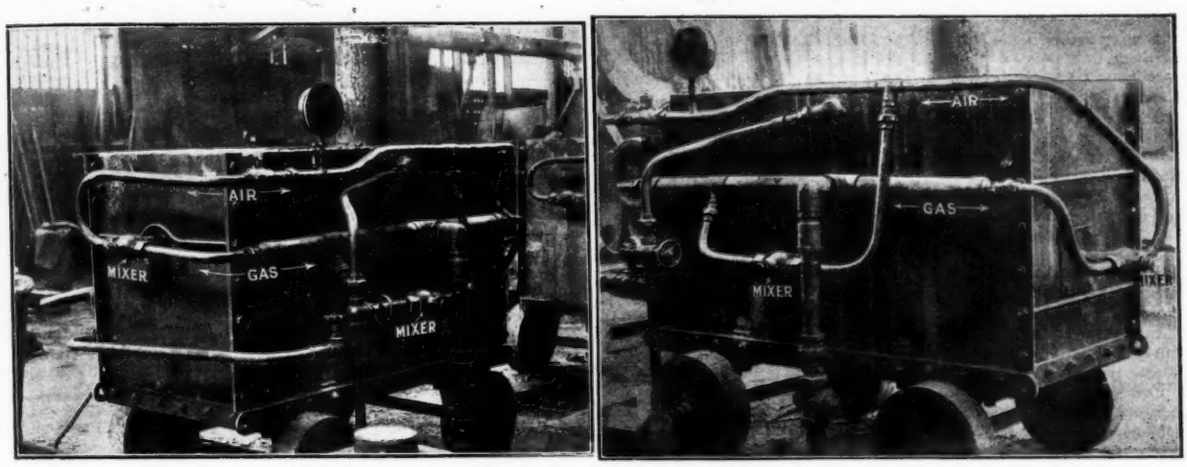
A Notable Instance of what can be Done by Gas.

I would like to draw your attention to one other instance of what can be done by gas. A gas-fired travelling oven for baking biscuits has been installed at the Co-Operative Society's Baking Factory, M'Neil Street, Glasgow, and has now been working for several months with excellent results. In fact, so satisfied are the Society with its working that they have placed an order for another oven of equal working capacity. I have seen this appliance under working conditions, and was very greatly impressed with its construction, simplicity of control, and efficiency. The oven in question is 50 feet long by 7 feet wide; and for a day's working of nine hours it was turning out 1¼ tons of biscuits, or at the rate of 11,000 per hour. The gas consumed was 850 feet per hour, which, at 2s. 1d. per 1000, is equal to 1s. 10d.

The oven is a baking chamber made of a double casing of steel sheets; the space between the sheets being filled with a suitable insulating material, so that the outside of the oven is never hot. The heat is produced by rows of patent burners running across the oven at the top and bottom. The pans, or wire trays, of biscuits are carried on patent roller chains between these series of burners. The speed at which the biscuits pass through the oven is regulated by a new patent adjusting gear, which gives a variation in the travel through the oven of from 4 to 48 minutes. In special circumstances, the latter speed can be still further slowed-down to any speed required. The heat is direct heat; the burners being in the baking chamber. It will be obvious to the practical biscuit baker that he can now, for the first time, absolutely control the heat in his oven, and that he can vary the heat —top heat or bottom heat, flash heat or slow heat—at will. The points in favour of this type can be set out categorically as follows:

Getting the Temperature.—(*a*) In 45 minutes the heat can be raised from 60° to 600° Fahr. This is an improvement upon the frenzied stoking that has to be done some hours before biscuits can be baked in a coke-fired oven.

Uniformity of Baking.—(*b*) A certain number of burners will be lit in the top and bottom to bake a particular kind of biscuit.



HALKETT'S PORTABLE GAS-FURNACE.

BISCUIT-BAKING OVEN.

This heat can be maintained without any variation for any length of time. Each burner is numbered, and the numbers will be recorded on a chart. When it is desired to reproduce this biscuit, the chart is consulted, the same burners are lit, and the biscuit is reproduced with unfailing uniformity.

Control of the Burners.—(*c*) Each burner can be lit and extinguished separately; the whole of the burners, or one-half, or one-fourth of them can be extinguished at once. The control is easy and absolute.

Full Calorific Value of Gas Used.—(*d*) The heat is derived from a mixture of gas and air (a mixture of gas and air being highly explosive); the gas is delivered under pressure from a special patent compressor, and the air is supplied just where the gas is lit in the patent burner. This produces a flame that will burn in any atmosphere without flickering; thus producing a constant heat and perfect combustion.

No Loss of Biscuits in Case of a Breakdown.—(*e*) Doors are placed in the bottom of the oven so that, in case of accident, every part of the inside is easily accessible. If the oven were stopped while it is full of biscuits, the gas would be turned off, the doors raised, and the dampers pulled out. The biscuits would then cool rapidly, and none would be destroyed. Anyone acquainted with the loss caused by a breakdown in an ordinary oven will appreciate this point.

Saving in Outlay.—(*f*) No foundations are required for this type of oven. Any level floor will do, in any part of a building. No repairs to furnaces. No ashes to be removed from the ground to the top floors. Anyone who has built an ordinary brick oven will see the advantage of saving the cost of foundations and underground passages for storing fuel, carting ashes, and stoking. The risk of striking water or shifting sand when excavating for foundations is a very serious one. This is all obviated by a gas-fired travelling oven.

Air Space Saved.—(*g*) The space occupied by a gas-fired travelling oven is considerably less than that of a brick oven. The floor space for a gas-fired oven, three pans wide, is somewhat less than that occupied by a two-pan brick oven. The space occupied in height is less than half that of a brick oven.

No External Heat.—(*h*) The perfect insulation prevents any heat being radiated into the bakery. The absence of heat from the atmosphere, added to the gain in space (see above), will be a great boon.

Every detail of this oven has been carefully thought out. For instance, there is a patent products of combustion extractor that not only takes away these products, but also, at the same time, keeps the hot air in the oven continually agitated. The heavy inert mass of steam-charged hot air—the *bête noir* of all biscuit bakers—that hangs in the roof of every other oven is, by this method, done away with. The burners can be taken out one by one (even while the oven is working) and examined, and, if necessary, cleaned and replaced.

The cost of running the gas-fired travelling oven varies according to the price of gas compared with the price of coke, or other fuel, locally. In making a comparison of the cost, the wages of a stoker, the cost of removing ashes, repairs to furnaces, renewals of fire-bars, the wastage of biscuits caused by "trials" being put through to see if the temperature is right, the total loss caused by a breakdown in the oven, and a proportion of the cost of foundations, must be added to the price of coke.

Some particulars of this oven were given recently in "A Thousand and One Uses for Gas" issued by the British Commercial Gas Association. The valuable services of this Association are of great assistance to the industry; and I would like to pay a tribute to them and to the Technical Press for the excellent way in which they devote themselves to promoting the cause of gas.

A Few Don'ts.

In order to point a few more facts about gas furnaces, I will include these "Don'ts," which will be found quite instructive.

Don't expect a furnace to do more than it was designed for.
Don't expect a natural-draught furnace to give results above 1000° C.
Don't use air blast when natural draught will serve.
Don't blame the furnace when anything goes wrong; examine your adjustments.
Don't blame the gas for low temperatures; examine your air pressure.
Don't blame the gas for oxidation; test your air pressure.
Don't work with an air pressure above that specified by the makers.
Don't work your furnace at higher temperatures than is necessary, it wastes gas.
Don't work your furnace with excessive flue draught; efficiency is lowered and the gas consumption increased.
Don't consider gas heating a luxury or expensive as a fuel; net results are what count.
Don't consider fuel costs alone; count the convenience and uniform results. It pays.
Don't run the gas supply smaller than the gas-rail; one size larger is better.
Don't expect to get results by cutting-down the gas consumption to the minimum.
Don't work without a control valve on the gas supply; it saves waste.
Don't take your air supply from high-pressure mains; reducing valves are necessary, though they cannot be relied upon.
Don't forget that bunsen flames should have distinct green cones to have proper combustion.
Don't forget that bunsen flames with luminous tips really waste gas.
Don't forget the gas consumption in any furnace is in proportion to the amount of work done.
Don't forget every heat unit absorbed by the work must be supplied by the gas.
Don't forget a cheap furnace has a short life and is a bad investment.

Recent Furnace Installations in Glasgow.

Before concluding, I append the following list of our recent gas-furnace installations, showing the types of furnaces, the purposes to which they are put, and their consumption per hour respectively.

Type.	Purpose Used For.	Consumption. Cubic Feet.
One annealing furnace	Copper bands for shells	300
Two high speed furnaces	Steel hardening	250 (1)
		250 (2)
One annealing furnace	Copper bands for shells	300
Two furnaces	Rivet heating	300 (1)
		300 (2)
Four oven furnaces	Hardening bullet proof steel	500 (1)
		500 (2)
		500 (3)
		500 (4)
One furnace	Tube welding for gas-cylinders	750
Two oven furnaces	Annealing copper bands	500 (1)
		500(2)
Two high speed furnaces	Steel hardening	250 (1)
		500 (2)
One large muffle furnace	Pottery work	450
One small ,, ,,	,, ,,	100
One lead press	Electric cable covering	1000
Note.—Through this converted system of heating a saving of 50 per cent. in time and 40 per cent. in cost is effected.		
One furnace	Tube welding	2000
Two 300-lb. tilting furnaces.	Melting gun-metal	600 (1)
		600 (2)
One lead bath	Melting metal	200
One annealing bath	Copper turnings	200
Two furnaces	Annealing metal	1000 (1)
		1000 (2)
Four furnaces	Annealing metal	500 (1)
		500 (2)
		500 (3)
		500 (4)
Four air-blast furnaces	Hardening metal	300 (1)
		300 (2)
		300 (3)
		300 (4)
One air-blast furnace	Punch hardening	250
Four air-blast furnaces	Tempering metal	200 (1)
		200 (2)
		200 (3)
		200 (4)
Four double-nosed air-blast.	Shell nosing	1000 (1)
		1000 (2)
		1000 (3)
		1000 (4)
Two revolving H.-P. gas-furnaces	Tin tempering baths	1000 (1)
		1000 (2)

The 44 furnaces detailed in this statement represent an hourly total consumption of 23,600 cubic feet of gas, or a daily consumption of 283,200 cubic feet. The above workings are taken from furnaces fixed during a period of three months, and give an idea of what a profitable field for consumption gas-furnaces are. Our furnace representative has taken great pains to work out and verify the figures for me; and I am greatly indebted to him for the amount of trouble he has taken.

DISCUSSION.

The President (Mr. Alexander Masterton, of Edinburgh) said Mr. Halkett was to be congratulated on having brought under their notice an extremely valuable and useful paper on a subject which promised great developments, and which was of paramount importance to the gas industry. The author's minute description of the inception, organizing, and carrying on of the new departure was specially interesting, as also his reference to the particular points of study required by those who desired to take up this branch of the business. It seemed to him, however, that Mr. Halkett was fortunate in having a suitable man on his staff whom he could train as a furnace expert. The data the author had given them for bolts, rivets, plates, and melting metals in connection with the furnaces would be helpful as a guide in making comparisons between solid and liquid fuel appliances; and the value of such a laboratory as Mr. Halkett had set up could not be over-estimated—more particularly in relation to similar undertakings. He understood Mr. Halkett would welcome inquirers, and give them the fullest details concerning these furnaces. He had been much impressed with the description of the gas-fire biscuit-oven which had been in operation in Glasgow for some considerable period; and he was well aware that a great deal of time and money had been expended in bringing this particular type of oven to its present state of perfection. In Edinburgh, they had been greatly interested in this movement, as the city was

quite a recognized centre for the biscuit trade. As a matter of fact, experiments were now being carried out in their area.

Mr. ALEXANDER WILSON (Glasgow) said the gas-furnace business in Glasgow had been a success from the very beginning. Of course, it was to be recognized that they had a grand field to work in, with their many shipbuilding and engineering works on the Clyde. The difficulty in Glasgow was to find room in which to instal their furnaces; and they were fortunate at the outset in securing premises which had been formerly used for an old foundry. This turned out to be a good investment; and it certainly materially helped them in carrying forward their work in connection with gas-furnaces. To his mind, they were just at the beginning of this gas-furnace business in Glasgow. The more they did, the better the people seemed to be pleased with it. Even though the fuel itself was costing rather more than under the old method, the advantages were so numerous as to more than compensate for increased outlay. People were all alike in this respect, that they rarely grudged increased cost if they could get what they wanted accomplished to their entire satisfaction. With the gas-furnace, once they got it properly adjusted, they could put in the material and withdraw it again just in the condition desired. Personally, he thought there was a great deal to be said for the uniformity of heating which the furnace gave; and when the adjustments were satisfactorily made to begin with, little in the way of re-adjustment was necessary. The last main that they installed in Beardmore's works was a 12-inch one. The undertaking on that occasion was rather a big one; but nevertheless it was quite successful. In point of fact, they did not anticipate at the outset that they would be able to carry out such a big heating arrangement in so small a space. Fortunately, the scheme was working really well; and he believed it was likely to be extended. Beardmore's case was merely one instance of a great many other furnaces that had been installed; and he certainly held the expectation that the future would see a greater development along these lines than had happened in the past.

Mr. ALEXANDER MACKAY (Motherwell) was much obliged to Mr. Halkett for bringing this subject to their notice; for, outside of Glasgow, he did not know another district which more required something on the lines described by the author than his own particular town. For some years back, in Motherwell, they had been unfortunate in not having sufficient gas to give their consumers; but in the near future they hoped to be in a position to remove this disability. In listening to Mr. Halkett's paper, it occurred to him that the crux of this whole question lay in the price at which they were able to supply gas to their consumers. He felt somewhat disheartened when he heard the author reading over the details relative to cost, because, no matter what a manager might do in reducing costs within the works, when he was tied by the neck as he (the speaker) was with heavy capital charges which had to be met, it was quite impossible to sell gas at the price that would induce the manufacturers in such a town as Motherwell to use gas-furnaces.

Mr. ARCHIBALD H. HAMILTON (Glasgow) said that some time ago he was informed by the author that he contemplated writing a paper on this subject; and having had some experience of the use of gas-furnaces in his works at Possilpark, Glasgow, he thought it advisable to take out some office figures in reference to the results attained. These figures went to show that gas was more economical than either steam or coal. With a steam-jacket boiler ¼ cwt. of wax took 90 minutes to melt, while the raising of steam occupied 45 minutes. This gave a cost 2s. 3d. for a man's time (2¼ hours), while the coal used represented an outlay of 1s. 6d. —a total of 3s. 9d. Using the same quantity of wax, the melting process was carried through in one boiler in 50 minutes; 150 cubic feet of gas being consumed. The cost for gas was 5d., and for workman's time 9d.—giving a total of 1s. 2d., or a saving in favour of gas of 2s. 7d. Then 2 cwt. of wax on a fire boiler cost for coal 1s. 9d. and for the time of the workman firing the boiler (2¾ hours) 2s. 9d.—giving a total of 4s. 6d. On a gas-boiler, the same quantity of material took two hours of a man's time, 2s.; while the gas used was 300 cubic feet, or a cost of 7d.—giving a total outlay of 2s. 7d. The saving there was again in favour of the gas-boiler to the extent of 1s. 11d. Two other sets of figures which he had taken out would be found interesting in this connection. In one case, he used a larger boiler and two smaller boilers, containing in all 9 cwt. of wax. These took seven hours to melt the material, and used 2400 cubic feet of gas—a sum of 4s. 10d.—while the workman's time represented seven hours at 1s. per hour. The outlay there was 11s. 10d.; but it ought to be explained that the gas pressure was very poor, and that with good pressure 1600 cubic feet of gas should have been ample. To some extent this was borne out by the result obtained with one large boiler, where the material dealt with was 7 cwt. The pressure of gas was good, and 1000 cubic feet were consumed; the cost being 2s. Three hours represented the workman's time, at 1s. per hour. The total expenditure was therefore only 5s. His figures accordingly went to show that everything was in favour of the gas-boiler. From the point of view of the industry he was connected with, he had found gas-furnaces to be most effective. Their utility for the work was unquestioned, and their economy had also been demonstrated. Altogether he had been thoroughly satisfied with the results; and any members of the Association who cared to visit the works could see the furnaces in operation.

Mr. DAVID VASS (Perth) asked if in Glasgow they had an arrangement whereby they gave special terms to consumers using large quantities of gas. He had the feeling that the question of the cost of the gas consumed might be an element which would interfere with the development of a venture of this kind. His own Corporation not long ago introduced a sliding-scale, as a result of which large consumers derived a benefit; and something of this kind, if generally followed, might be an inducement to manufacturers to use gas-furnaces.

Mr. HALKETT, in replying to the discussion, said he was indebted to Mr. Wilson for his observations. That gentleman knew his (the author's) views tolerably well, as to the future field for the consumption of gas in the furnace line. He was clearly of the opinion that they could look to the furnace as one of the biggest aids to gas consumption, particularly in a city like Glasgow. So far as the point raised by Mr. Mackay was concerned, he might remark that gas-furnaces could be worked economically, and as cheaply, to compete with a fuel furnace, anywhere round about 2s. per 1000 feet. An instance was quoted in his paper where the cost came down to 1s. 6d. per 1000 cubic feet; and he would be surprised if there were not a large number of manufacturers who were using gas at less than that sum for munition purposes. Personally, he did not see why they should not be able to compete with solid fuel anywhere where the price of gas ran from 2s. to 2s. 3d. per 1000 cubic feet. The chief thing was to endeavour to get people to use their furnaces economically; and it was in giving instructions and hints on this point that they found their expert to be advantageous in Glasgow. Much depended on the skill of the operators, and care had to be taken in the regulation of the valve. The idea of the gas and air mixer was to get a fixed adjustment, so far as this was possible to obtain.

GAS AUTHORITIES AS SUPPLIERS OF ELECTRICITY.

By J. W. NAPIER, of Alloa.

[A Paper read before the North British Association of Gas Managers, Sept. 1.]

The object of the author in presenting this paper is to create an interest in the supply of electricity as an agent in providing light, power, and heat for public needs, and that the dual supply can most profitably be given by the existing authority for gas supply —company or municipality—having regard to the economics of the question from the point of view of both the supplier and the consumer. He does not wish to discuss the merits of the illuminants as such, or indeed to consider gas and electricity as rivals —this is a fast disappearing conception, and happily so—and to disclaim any idea of opposition to purely gas interests. It is not intended that this review of the subject should have reference to the larger towns or to areas already supplied by electricity authorities having parliamentary powers.

In these times of change and overthrow, it becomes us to take a fresh perspective of events and condition of things, so that the horizon of our outlook may be widened and the scope of our responsibilities broadened and strengthened. In this regard, the trend of things has undoubtedly been towards the centralization of supply, no matter what the commodity may be. Competition as a factor in serving the public interests most economically has been of great value; but it may be carried beyond the limit of sound judgment. It is to be remembered that the supply of gas and electricity as a monopoly in the hands of one party has the safeguarding and watchful control of Parliament. The author is quite aware that in Scotland several gas companies have for some time past been seriously considering the supply of electricity. There are several instances where parliamentary power has been granted to gas companies for electricity supply—notably the Tottenham District Light, Heat, and Power Company. It is hoped, therefore, that this contribution will be timely, and of value, to those considering the matter, and that the experience and results obtained at Alloa will present a satisfactory reference. An address entitled "Gas Authorities as Suppliers of Electricity" was read by the author to the Scottish Junior Gas Association (Western District), on April 12, 1913, to which further reference may be made.

ALLOA CORPORATION UNDERTAKING.

The Alloa Electric Lighting Order was obtained in 1899, and the Town Council immediately concluded an agreement with a Company for a bulk supply to be continued during a minimum period of fourteen years. The arrangement was that the Corporation took delivery of the current at a sub-station in the town, and thereafter themselves undertook the distribution, having provided and laid down at their own expense the street cables. The arrangement for a supply from the Company was doomed to failure. This was entirely due to the excessive rates of charge imposed upon the Town Council. The price was arranged upon the maximum demand principle at £9 per kilowatt demanded and 1½d. per unit supplied. The charge to the consumer for power was a flat-rate of 2d. per unit; lighting, 7d. and 3d.

Without entering into the history of affairs, it may be stated shortly that for a period of almost ten years no progress whatever was made; the quantity of current sold being a minimum amount, while the sources of supply for power purposes, more especially, remained untapped. Not only so, but, owing to the small turnover of business and the capital expenditure involved in cables being considerable, the Department sustained an annual loss of

from £300 to £500 during the period of the agreement for a bulk supply. This deficit was met out of the profits of the Gas Department as provided for in the Electric Lighting (Scotland) Act, 1891, which states that any loss resulting from the working of the electricity supply shall be met from the local rate, which is the gas-rate, or, in other words, the gas profits. In order to end the unfortunate position of affairs, the arrangement with the bulk supply Company was terminated by mutual agreement; the Corporation paying an indemnity of £3000. As this did not represent assets which could be termed capital expenditure, the gas profits were once more appealed to; and the payment of the sum in question was spread over a period of six years. The full amount has now been paid.

Site for the Electricity Station.

It was now possible to decide upon the erection of a station. The question of site had first to be determined, and the ideal site for an electric station is a point in the centre of, or so far as is practicable nearest to, the area of greatest demand for current, in order to reduce the cost of supply cables, which otherwise would require to be larger, and carried a considerable distance at greatly increased cost. The gas-works site was ultimately decided upon for the following reasons: (1) Spare ground available sufficient for future extension and at a low rate of feu-duty. (2) Being at the gas-works, a supply of fuel, either coke or coal gas, was available. (3) The gas and electricity stations being under the same management, supervision would be more convenient and the same offices and staff mutual to both. (4) Extra labour and assistance from the gas-works could be given when required. (5) The gas-works site is situated in the industrial area where a large day demand for power was likely to arise. (6) Private source of water supply available. As a result of experience now obtained, the situation of the generating station at the gas-works has proved most satisfactory, and the convenience and advantages are real and considerable.

Type of Plant.

The type of plant to be erected received careful consideration, and in this regard the following points are to be noted:

Steam Plant.—The station being a comparatively small one the stand-by losses would be considerable, and turbine plant is only economically possible for large units.

Oil-Engines.—The price of oil would probably vary from time to time, which would seriously interfere with works costs.

Producer Gas Plant and Gas-Engines.—Gas-works coke as fuel available in ample supply, and price controlled by ourselves and not subject to railway dues; while the water supply available for the gas plant and cooling of engines would prove a distinct asset in practical working—also a supply of coal gas as a stand-by at low power rate.

A suction producer gas plant with gas-engines was, therefore, decided upon as the most economical type of plant best suited to the local circumstances. The gas-engine, while it cannot be claimed to possess the high standard of reliability of the steam-engine, has, in our experience, proved satisfactory, when given proper attention; and when specially built for driving generators, a steady voltage is obtained.

Description of Plant Installed.

As regards the actual plant installed, it is not intended to give more than a short general description. In 1910, the plant first put down consisted of one 85 B.H.P. and one 140 B.H.P. gas-engine, with dynamos direct coupled with one producer gas plant for use with gas coke. A storage battery (Tudor) of 221 cells and capacity was installed to meet the demand after 11 p.m. and on Sundays. The battery is insured with the makers for a period of ten years for an annual payment of £41—being 10 per cent. on the purchase price; they undertaking to keep it in good working condition and at the end of ten years to hand it over of full efficiency and equal to new. The capacity of the battery is relatively very small to the demand, and its chief function of value is to permit of the engines being run at an efficient load—taking up the excess current generated, and meeting any slight extra demand when required. The usual switchboard is provided with the necessary panels for the separate machines—a balancer and an automatic reversible booster for charge and discharge of current with the battery.

In 1911, the output of current had so increased that additional plant was required, and a twin-cylinder horizontal type engine of 250 B.H.P. with generator was installed with two separate sets of producer gas plant for use with coke. The cylinders of the engines installed up to this time are water-cooled on the thermal tank system. The capacity of the water-tanks was based upon 45 gallons of water per B.H.P.; but experience has shown that this figure is much too low when gas-engines of 100 H.P. and over are working ten hours per day at three-quarter load. Mechanical water coolers, or cooling towers, are necessary for efficient cooling of the cylinder jacket water if trouble is to be avoided from seized pistons due to faulty lubrication caused undoubtedly by the viscosity and lubricating quality of the oil being reduced at too high a temperature.

In 1914, the demand for electricity had increased to an extent that required more generating capacity of plant. After careful consideration, and in view of the satisfactory working of gas-engines and producer-gas plant that had been running for three years, it was again decided to proceed with the extension on the same lines. A much larger unit of plant was now installed—a vertical engine of 600 B.H.P., with eight cylinders, together with two sets of producer plant of ample capacity. For the cooling of the water required for the cylinders, a cooling tower was erected with duplicate centrifugal pumps, motor driven. With an arrangement of underground and overhead water tanks and pumps, the water required for the producers is circulated through the scrubbers over and over again; it being only necessary that the water be cooled sufficiently. The scrubbers, while fed with a constant supply of water, do duty chiefly in cooling the gas; there being no impurities to absorb except sulphur gases. When some qualities of anthracite are used in the producers, or gas coke from horizontal retorts, very great care must be taken to clean the gas thoroughly from all traces of tar. This tar, so called, is really a gummy substance which, if allowed to pass through to the engines, gives no end of trouble with sticking valves and deposits at the back of the pistons, causing pre-ignition.

One of the disadvantages of horizontal retort coke is the presence of volatile matter in excess, causing trouble in the working of the engines. To this is due probably the reason why gas-works coke for producers has not met with general favour. In the extraction of tar fog from suction producer gas, the author's experience has shown it to be a difficult problem. The frictional contact with roughened surfaces in the form of wire grids, causing precipitation of the tar, has proved the most successful. With the use of vertical retort coke, however, all tar troubles immediately cease; the volatile matter in this coke being practically *nil*.

The supply is on the three-wire system—220 volts for lighting and 440 volts for power. Since 1914, the output of current has rapidly increased, and at the present time a 700 B.H.P. vertical engine and generator are in process of erection. This additional plant is on the same lines as that already described. The following statement shows the several sizes and year of installation of the generating plant:

Generating Plant Installed.

Year.	Engines.	Generators.
	H.P.	K.W.
1910	85	52
	140	95
1911	250	162
1914	600	410
1916	700	485
Total	1775	1204

Output of Electricity.

The increase in the output of energy is shown in the following statement:

Consumption of Electricity.

Year.	Private Lighting.	Power.	Public Lighting.	Total.	Maximum Load on Feeders.
					K.W.
1911	55,460	13,922	28,938	98,320	85·0
1912	59,145	92,015	27,397	178,557	103·6
1914	88,037	247,060	24,845	360,942	229·0
1916	135,821	642,347	11,794	780,963	440·0

It will be observed that the greatest increase has been for power purposes; and this has had a very important influence on the working results and success of the station. With an industrial day demand, and therefore a long hour load, the plant is kept working when otherwise it would be largely standing idle and would be running only during the short period of peak load. The value of a day-load to an electric station is further evidenced by the low rates of charge per unit for power compared with the charge for lighting units. This I shall endeavour to justify later.

Cost of Production.

Regarding the cost of production of current, the following statement gives the working results for the past year. It will be noted that the data are on the basis of per unit sold as ascertained from the consumers' meters, and include all stand-by losses for fuel in producers, battery losses, current used in station for lighting and power, and the transmission losses in the distribution of energy:

Working Costs per Unit Sold.

Year ended May 15, 1916.

	Amount.	Per Unit Sold.
Fuel	£767 0 2	0·23d.
Oil, waste, water, &c.	363 11 10	0·11
Wages of workmen	951 10 5	0·29
Repairs and maintenance	432 4 9	0·13
Rents, rates, taxes	114 8 9	0·04
Management, office, and legal expenses	159 6 8	0·05
Insurance of plant	187 11 1	0·05
Total	£2975 13 8	0·90d.

The price charged for coke was 13s. per ton. The employees at the station are as follows: One station engineer in charge, three shift engineers, three switchboard lads, two men on the gas-producers, and one jointer for distribution work. As bearing out the low cost for fuel, it will be useful to make comparison with other stations of similar size, and of stations having a much larger

output. The towns are represented by letters, and are all in Scotland.

Comparison of Fuel Costs with Other Towns.

Town.	Annual Sale.	Fuel only. Per Unit Sold.
	Units.	d.
A	89,000,000	0·23
B	18,000,000	0·34
C	15,000,000	0·22
D	10,000,000	0·27
E	4,000,000	0·41
F	3,000,000	0·25
G	1,600,000	0·57
Alloa	800,000	0·23

For stations of the size of Alloa, gas-engine driven generators and producer gas plant undoubtedly provide low works costs; and our experience amply proved the wisdom of the choice of plant.

Prices to Consumers.

Lighting . . . . . 4d. per unit.
Power—
For all current consumed up to
2,000 units per annum, 2 d. per unit.
4,000 " " 1⅞d. "
8,000 " " 1¾d. "
16,000 " " 1⅝d. "
24,000 " " 1½d. "
65,000 " " 1⅜d. "
100,000 " " 1 d. "
135,000 " " 0·9 d. "
Units over 135,000 " " 0·8 d. "

Rates for Lighting for Large Power Users.

When the consumption of electricity for power by any consumer is over 65,000 units and not exceeding 100,000 units per annum, the rate for all energy supplied for lighting to such consumer's premises will be 1¼d. per unit, and when such consumption is over 100,000 units per annum, the rate for lighting will be 1d. per unit. In addition, an extra 15 per cent. on power and 5 per cent. on lighting will be charged until further notice.

Justification of Low Power Rates.

In order to anticipate criticism in regard to the charge for power units of 0·8d. when works costs amount to 0·9d., and the impression that has obtained credence in certain quarters that electrical energy is frequently sold below cost, it is necessary to analyze the works costs of the several items: "Rents, rates, and taxes," "management, office, and legal expenses," and "insurance of plant" are standing charges; while "wages at works" will meet an expanding output without any sensible increase. The works charges concerned in the actual cost of each unit sold are fuel, oil, waste, water, &c., and in part only wages of workmen and repairs and maintenance. Making the cost per unit 0·6d., there is sufficient margin left; and on a sale of (say) 100,000 units per annum the surplus would be fully £80. A number of power consumers of the extent indicated when their consumption is aggregated together provide a considerable demand; and it is not possible to get large consumers of electricity unless enticingly low rates are offered, as, of course, competition from private plants has to be met.

Financial Results.

	1915-16.
Capital	£33,217
Revenue—	
From private lighting	1,988
" power and heating	2,832
" public lighting	123
Rents, royalties, &c.	13
Total	£4,956
Working costs	2,976
	£1,980
Gross profits—	
	1915-16.
Before providing for interest, &c.	£1,949
Percentage to capital outlay	5·96
Interest	949
Sinking fund	987
Surplus	44

Economical Use of Coal.

In using coke as fuel for the production of electricity, a product of the distillation of coal is being utilized; the raw coal having been consumed in the vertical retorts in a scientific manner, yielding a satisfactory heating gas for industrial and domestic needs as well as a smokeless solid fuel, and the other valuable bye-products tar and ammonia. This aspect of the generation of electricity from gas-engines with producer gas made from gas-works coke as the fuel is of extraordinary importance from a national standpoint, having regard to the present wasteful use of coal direct to generate electricity. The evidence can be focussed in brief. The gas manufacturer distils coal, producing gas for domestic heating and lighting for a great variety of uses in the industries for heat and power; coke as a smokeless fuel; the production of tar, with its multitude of uses and its value to the dye industry; the production of liquid fuel for internal combustion engines and the basic material for the production of explosives; ammonia as the source of nitrogen as a food for plants.

The use of coke for the generation of electricity prevents the wasteful use of coal as an asset of national value; and the combination of gas and electricity production in the manner outlined is a singularly good example of realizing in a highly economical way the value of coal. Attention may be called to the dictum of Professor Armstrong in a paper read at the annual meeting of the Society of Chemical Industry recently held in Edinburgh—"the gas-works will be called upon to produce both gas and soft coke and to serve as the primary fuel supply in its district. Moreover it will almost necessarily be run in conjunction with the supply of electricity. Already the Brighton Corporation have made arrangements for the installation of coking plant alongside their electric works—the gas to be used in firing the boilers of the latter."

Ammonia Recovery Plant.

The producer plant in use at Alloa is of the suction type, and therefore the nitrogen value of the coke has not been recovered as ammonia. The installation has been too small to warrant the capital expenditure for recovery plant; but with the horse power of engines now installed, a scheme for producer gas plant of the Mond type, with recovery plant, has been considered and determined upon. It should be explained that conditions of war have prevented the expenditure of money on new plant, and the installation has therefore been delayed in erection.

The conception of the scheme is as follows: Coke contains about 1 per cent. of nitrogen and the results of experiment on the large scale have shown a yield of 30 to 40 lbs. of sulphate per ton. Compared with a yield of 80 to 90 lbs. of sulphate from bituminous coal, this amount is disappointing. The reason for this difference in yield between a fuel of the nature of coke and bituminous coal can, however, be well explained, but need not be discussed at this time. The Mond plant will be erected on the gas-works site, and a supply of producer gas will be afforded to both works—to the gas-works for heating the retorts, and to the electricity station for driving the gas-engines. It will be noted that the nitrogen value of the coke used in the producer is lost with the existing arrangement. The gas-works are already equipped with plant for the manufacture of sulphate of ammonia, and this plant will in part be available.

The author lately inspected installations of Mond gas plant at a gas-works where all the retorts were being heated by gas, and also a comparatively large electricity station where the Mond gas was in use for driving 3000 H.P. of gas-engines. In his own case, the circumstance of the gas and electricity works being on the same site should make the scheme an admirable one. It may be seen that a scheme of this kind will prove how the value of coal can be so much better realized in a comprehensive way, having regard to the sequence of operations and the bye-products produced from the coal from first entering the vertical retort to the generation of electricity.

Advantages of Joint Supply.

The strongest evidence I can bring to prove that the electricity has a permanent place in public demand coincident with a large consumption of gas, and that competition does not enter in to destroy the interests of either department, is the example of the gas and electricity supply of Alloa. For many years Alloa has enjoyed a low rate for gas for lighting and cooking in pre-war times of 2s. 1d. to 2s. 4d. per 1000 cubic feet, and a specially low rate of 1s. 4d. to 1s. 10d. for power. Every facility has been given to consumers to take advantage of the use of gas—*e.g.*, free gas cookers since 1905—with the result that for a population in the area of supply of 17,200 the gas manufactured per annum is equal to 150 million cubic feet. The average annual consumption per ordinary consumer is 32,400 cubic feet; per slot consumer, 19,800 cubic feet; and per power consumer, 273,700 cubic feet. Taken on the basis of population, the consumption of gas is considerably higher than with most towns in Scotland—indeed, it may be stated to be exceptional.

As regard the consumption of electricity, it will be noted from the statement already given—that the annual output has increased from about 100,000 units in 1910 to about 800,000 units in 1916. The author is not conscious of any collision of interests in supplying the two forms of energy—new consumers are not lost, as they are bound to come to us for supply—and is only concerned with the joint success of the two works forming one department of business. Consumers demand whatever form of energy is most convenient and best suited to their requirements; and they are supplied accordingly. A show-room was recently opened in which there is exhibited lighting, heating, and cooking apparatus for both gas and electricity.

The directors of a gas company, in considering a scheme for electricity supply, may reasonably conceive that, by embarking upon an electricity scheme, the consumption of gas will be lessened and electricity take its place—a simple case of adding business to one undertaking that has been taken away from the other—and that the result would be a duplication of capital for additional plant without adding profits. Such a view is dangerously wrong. Of no area of gas supply can it be said at the present time that the use of gas has reached the utmost limit; and an increase in consumption for domestic use, as well as for industrial needs, should yield an increasing output from year to year. Certainly there should be no diminution of gas consumption if business methods are pursued. To embark on an electricity supply scheme would simply be pursuing the same line of business, but by a different avenue. It must be kept strictly in view that where electricity is available for lighting it will command a fair share

for domestic use, while for public buildings and shops preference is given to electricity. The question of the relative cost of gas and electricity may not enter into consideration in coming to a decision. Further, considering the adaptability of the electric motor, there will be a certain displacement of gas-engines thereby, and for larger units of power electricity will be installed.

It will be perceived that with this view of things the advantages and gain will be with the company supplying the two kinds of energy. Provided the area concerned is a suitable one—industrial preferred, so as to obtain the highly valuable day load—the electricity side of the business can, in my opinion, be made remunerative if diligence is shown (1) in keeping down the capital account; (2) in selecting a type of plant, the working of which will be conjoint with the interests of the gas-works; (3) that the gas-works be selected as the site for the generating station; (4) to disassociate in practice any spirit of competition and to push the sale of electricity as a legitimate and remunerative business. From the point of view of the interests of the public, it is not desirable that there should be a duplication of works supplying the one kind of commodity, though in two different forms, as the increased cost of production must fall on the consumer.

From the evidence now adduced, it may be fairly claimed that the co-existence of gas and electricity supply under one control is at once a practical and commercial proposition. The fresh field of business will appeal chiefly in the case of towns where there is at present no electricity supply. It is my settled conviction that what is required of the gas industry of to-day is a broadening of the basis of its function as suppliers of the public need for energy—gas and electricity. There is small doubt but that gas companies, if they do not prepare the way, will be met in the near future with competition where there is no electricity supply at present. It is a true indication of strength and vitality when an industrial business can comprehend the issues that lie in front of it, and, having done so, prepare accordingly.

DISCUSSION.

The PRESIDENT (Mr. Alexander Masterton, of Edinburgh) said they were indebted to Mr. Napier for his edifying treatise. He thought the author had made out quite a good case for gas authorities taking over the supply of electricity, especially in districts where the gas and electrical undertakings were in close connection with one another. The strongest argument to his mind was the economical use of coal which was involved, in such an arrangement—and this was a question to which a good deal of attention had recently been given. It would require extended study in future to do what they could to conserve supplies. Mr. Napier's experience and the data he had given ought to be of considerable assistance to municipal authorities who were considering the problem of the supply of light, heat, and power. Placed under the jurisdiction of a capable engineer and manager, and one without bias either towards gas or electricity, the joint management ought to be in favour of economical working, and the production of these two agents to the public at cheap rates. There was no reason why the two competitors should not work side by side, promoting the interests of each in the best possible way. They all owed a debt of gratitude to Mr. Napier for bringing this useful subject before them, because it was seldom they had an opportunity of getting the particulars relating to these two agents presented in such a clear and concise manner, and in an altogether unadulterated form.

Mr. DAVID ROBERTSON (Dunoon) said he could speak with no perfect knowledge of the subject under discussion except in so far as he had heard the views of Mr. Napier. In general, however, he thought the author was quite correct in stating that there need be no rivalry between gas and electricity provided they were under one control. He believed, further, that the author was right in stating that consumers would demand the energy which they desired, and he considered Mr. Napier was also on right lines when he stated that gas companies ought to have the control of the electricity supply of a district. It was good business to proceed along these lines, because the combination might lead to much less expenditure. He agreed with the author that when the electricity station was in the gas-works there must be very great economy exercised.

Mr. WALTER GRAFTON (Glasgow) considered that the paper opened up a large field for discussion. The author referred to gas appliances, cookers, and the like. On this point he would ask Mr. Napier what terms he offered the electrical consumers in relation to appliances. Was there an arrangement to purchase outright, or was it simply a case of hire? One vital point tending to the economical running of the electricity plant, from the point of view that the author had expounded, was that the utmost attention should be given to lubrication.

Mr. DAVID VASS (Perth) pointed out that Mr. Napier did not give any indication in his paper whether there was a tramway system connected with the undertaking in Alloa. To his mind, this might have a bearing on the electrical question.

Mr. WILLIAM WILSON (Falkirk) said Mr. Napier's contribution was admittedly one which gave them much food for thought. Some of the ideas embodied in the paper had been talked about by eminent men for many years, and he thought the district of Alloa was to be congratulated on the undertaking and the up-to-date lines on which they had fashioned their scheme for economizing fuel. He might remark that when he was in Kirkintilloch he very nearly took up the same position as Mr. Napier had done. They had a scheme there for putting up an electrical station in connection with the gas-works, and, much against his will, he canvassed the whole town on behalf of electricity. It appeared to him, however, that Mr. Napier would have to adjust his prospectus considerably if he was asked to take charge of a purely electrical undertaking. At the same time, he was to be congratulated on being in a position where he could hold the balance equally between the two forms of energy. The author mentioned in the course of his paper that, by introducing Mond gas for heating the retorts, he was going to effect considerable saving. He explained that in the present system the nitrogen of the coke consumed in the furnaces was lost. If, however, he introduced Mond gas into these furnaces, he presumed that Mr. Napier's intention was to sell the coke which at present he used in the furnaces, and the nitrogen would still be lost—at least, someone would be putting it up the chimney. He would take the first opportunity that presented itself of going to Alloa to see the Mond gas plant whenever it was brought into action. Frankly, he had the feeling the day would soon come when far more undertakings would be on the same basis as they were at Alloa. The restrictions and economies in fuel that were being imposed upon them to-day would very likely be increased in the near future. In fact, the situation would be such that they would require to economize and save every residual out of the fuel which they might be allowed to keep.

Mr. CLARKE (Chesterfield) said he happened to be in the unique position of being Chairman of a gas company manufacturing 220 millions cubic feet of gas, and Vice-Chairman of an electrical undertaking which had plant of 2500 kilowatts. There appeared to be a feeling among some people that the two interests were antagonistic—indeed, in the gas company he was suspected of having leanings towards the electric undertaking, and in the latter concern the same feeling prevailed in regard to his attitude towards the gas company. The great point, however, that he had uppermost in his mind was that two separate sets of conditions obtained in regard to both undertakings. In a gas undertaking, the conditions required not only an engineer but one who was also a chemist and a keen commercial man. On the gas side, there were many business details which had to be grasped and attended to which did not appertain to the electrical undertaking at all. Then, on the electrical side, they had a totally different set of conditions—conditions which involved that the person responsible for management should have had a separate training. He thought the necessity for special training was obvious if the electric undertaking was in a town of (say) 40,000 or 50,000 inhabitants. Perhaps a desirable arrangement would be to have two men, each running his own particular plant, under the guidance and supervision of an engineer possessed of the ability to hold the balance evenly between the two undertakings. Rightly or wrongly, he was of the opinion that the status of the gas engineer was not sufficiently recognized—particularly in the smaller works and towns; and it was for this reason he urged that a separate man should be responsible for each installation, with a higher official in authority over both, charged with the duty of seeing that no particular interest suffered at the expense of the other. There was no doubt that the day of electricity for power had come to stay. At the same time he had the feeling that it was only in the smaller towns, or (say) residential towns, where a combined or joint undertaking would be found more economical. So far as the works with which he was associated were concerned, he believed the gas consumption was nearly 4,000,000 cubic feet per annum, while he believed the electric consumption was in the region of half-a-million units. From the experience acquired there, he failed to see how the two concerns could be combined in a practical and reasonable manner so as to make each the success it ought to be made.

Mr. GRAFTON said he would be glad if Mr. Napier would state the amount of leakage in the electrical mains.

Mr. J. B. SCOTT (Cowdenbeath) did not quite agree with the author's conclusions in regard to the financial results—indeed, he was a little afraid that, from the returns he gave in his paper, very few gas companies would care to take the matter up. It seemed to him as if the Gas Department in Alloa was suffering with a view to help the electrical undertaking. It would be observed that in the course of the paper Mr. Napier explained that the price charged for coke for the electrical undertaking was 13s. per ton. On this point he would ask the author if he could have bought coke at 13s. a ton during any period of last year for the manufacture of suction gas?

Mr. NAPIER, replying to the points raised in the discussion, said that in Alloa there was no tramway system. In regard to selling appliances, they would all be aware that the Electric Lighting Act did not give power to a local authority to sell them. The unaccounted-for current, amounting to about 7½ per cent., was largely due to transmission losses. Mr. Clarke, of Chesterfield, had raised a very critical point when he doubted the likelihood of a joint undertaking being a commercial and practical success. He was careful to point out in the paper that his advocacy of a joint scheme did not apply to towns of considerable size. In such cases, he frankly admitted that separate management was not only desirable but necessary. Taking a broad view of things, however, he was satisfied that, for towns of a population up to about 20,000—either industrial or purely residential towns—the gas supply authorities, whether a company or a municipality, had a distinct opportunity at the present time of looking before them and installing an electricity supply. After all, where they had any element of competition, the best plan to remove the competition was for the conflicting interests to amalgamate.

Probably some of the members would be disposed to say that competition was the life of business; but to-day it was bound to be recognized that the interests of a gas company and an electricity company were largely bound up together. In 1910, when the scheme at Alloa was put in operation, the retorts in the gas-works were all being used. There was no spare plant available at all; but this defect had now been remedied. He had before him a statement which he considered was very valuable in respect that it gave a comparison of the cost of fuel—producer gas and coal—for gas-engines on a large scale at the generating station. The statement was as follows:

Year 1915-16.

1.—Coal gas—	
Maximum demand	550 H.P.
20 per cent. load factor.	110 H.P.
110 × 365 days × 24 hours . . .	963,600 H.P. hours.
963,600 × 22 cubic feet. . . . . of coal gas to be supplied.	21,200,000 cubic feet
2.—Producer gas—	
Fuel	£767
Repairs and maintenance	75
Wages	210
Water	50
Interest and sinking fund on capital cost of plant (£2200 at 10 per cent.)	220
	£1322

The point he had to emphasize was that if the 21,200,000 cubic feet of coal gas which would have been used to supply the horse power demanded in the electrical station in that year had been so supplied, then it could have been furnished at an equivalent price by producer gas at the rate of 1s. 3d. per 1000 cubic feet. He gave the figure, which was one of considerable value, because it might prove helpful. He had to add that the circumstances in the Alloa Gas-Works in 1910 were altogether opposed to putting down gas-engines using coal gas.

The Production of Carbides.

According to an abstract of a recently-issued patent specification, given in the "Chemical Trade Journal," the Albi-United Carbide Factories, Limited, claim as their invention a mixture of gas coal or caking coal and lime or limestone subjected to a coking temperature above 700° C. By thus heating the mixture of lime and coal in a retort or otherwise, till coking of the coal has taken place, a product is obtained which contains lime and carbon in the desired intimate admixture. This product, which is in the form of pieces, remains in this condition, and also retains its hardness up to the point where it is smelted to form carbide. The advantage of using this product in the smelting operation resides in the fact that a considerably larger output is obtained for the same expenditure of power; while the working of the furnace becomes even, and the consumption of electrode material is surprisingly low. The process also presents other very important advantages, as, for example, the possibility of using limestone, which, in the ordinary way, on being burned, crumbles to powder. Further, the gas coal or caking coal is more easy to obtain, and is also cheaper, than the carbonaceous materials (anthracite, coke, and charcoal) which have been used hitherto.

Extracting Gasoline from Natural Gas.—Writing in No. 11 of "Metallurgical and Chemical Engineering" [New York, June, 1916], Messrs. Burrell, Biddison, and Oberfell describe their absorption process for extracting gasoline from natural gas, which has assumed industrial importance as the demand for gasoline has increased. The scheme is practically identical with the process for extracting benzol and toluol (light oil) from coke-oven gases, as used for years in Germany and to a very large extent during the years 1915 and 1916 in the United States. A difference lies in the fact that coke-oven gases are treated at about atmospheric pressure, while natural gas is treated at pressures as high as 200 lbs. to 300 lbs. per square inch. This is an economic necessity, because natural gas is transported at high pressures, and it is not desirable to disturb the system. To the best of the authors' knowledge, the first large-scale installation for extracting gasoline from natural gas by the absorption process was placed in Hastings, West Virginia, by the Hope Natural Gas Company, of Pittsburgh. All natural gases, except those that contain methane only as the combustible gas, contain gasoline vapour, though in some cases the amount is very small. Natural gas from two different fields that the authors tested contained gasoline to the extent of 1 pint per 1000 cubic feet in one case and 1·5 pints in another case. About 50 million cubic feet of natural gas per day were available for treatment. Oils which the authors experimented with to act as absorbents for the gasoline were about 35° Baumé specific gravity, and started to boil at about 400° to 462°. They were petroleum distillates. It is necessary that their boiling-point be much higher than the boiling-point of gasoline in order to make the extraction of the latter by distillation easy. Some tests were made in which the natural gas was simply passed into a naphtha of about 55° Baumé. Yields varying between 300 and 500 per cent. greater than that by the oil absorption and distillation process were so obtained.

CARRYING A LINE OF MAIN PIPES ACROSS A RIVER.

An interesting account of the details incidental to the carrying of a double line of 10-inch wrought pipe, together with twelve lines of cables, across the Brazos river at Waco, Texas, contributed by Mr. C. R. Sutton, appears in "Gas Age" (New York).

The operations were subject to difficulties of an unusual character. This part of the river is subject to sudden freshets, of sufficient violence to displace unfinished work or scaffolding, and the entire bed of the river is covered with deep layers of quicksand. Yet the job was completed without a hitch; and the pipes and cables are reported as being in satisfactory operation. Immediately overlaying the bed rock is coarse sand and gravel 9 feet thick, and above this about an equal thickness of quicksand, alternated with layers of clay and fine, sharp sand. It was decided to sink the pipes and cables well into the upper part of the gravel, and to firmly anchor them. A trench or cutting, 12 feet deep, through the quicksand, was necessary to secure this result, and a wall of sheet piling across the river, on the up-stream side, to keep the trench open and free from silt. A temporary bridge, of sufficient strength to carry a travelling pile-driver and derrick, were also required.

The whole of the pipe joints were made by the oxy-acetylene welding process; the gases being carried in portable cylinders that could be moved about as required. The pipes, which were $\frac{3}{8}$-th inch in thickness, were first joined-up in lengths of 100 feet, on the river bank. The ends were plain straight cut, and the plan followed was to fix two ends $\frac{3}{8}$-th of an inch apart and to make up a homogenous metal joint by the use of Norwegian iron welding wire as a filler. The time occupied in making a joint on the unbevelled pipe was 45 minutes; but with bevelled ends as now supplied a joint can be completed in 30 minutes, with a consumption of about 35 cubic feet of compressed oxygen, 21 cubic feet of compressed acetylene, and 14 ounces of filling wire. The total cost was about 4s. 7d. per joint. The strength of the welded joint was proved by supporting it on a long block, leaving the ends free. A man standing on each end (thus gaining a long leverage) did not strain the joints, and under a pressure of 90 lbs. per square inch they were perfectly sound. The full length of pipe having been prepared, the sections were pulled out over the river and joined-up as rapidly as possible. The line having been completed, the whole was coated with asphalt, and two lappings of burlap, each lapping also receiving a coating of asphalt.

The efficiency of the oxy-acetylene process was further illustrated. The line of pipe being ready for the drip-boxes, the castings were delivered from a distance, and turned out to be so full of blow-holes that they were useless. As the delay incidental to the supply of a new set would have been simply disastrous, two wrought-iron drip-boxes, each 2 feet in diameter and 5 ft. 6 in. deep, were rapidly and economically constructed from boiler plate on the site; all seams being welded with the oxy-acetylene blow-pipe, which was also used for cutting the plates to size. Stronger and neater seams were obtained than was practicable by the usual method of punching and riveting. The line of pipe would not sink by its own weight, and pieces of steel piling, each about 1 cwt. in weight, were cut up the blowpipe, and attached at 20 feet intervals, in order to ensure a proper settlement in the bottom of the trench.

EFFECTS OF FUEL COMBUSTION ON THE ATMOSPHERE.

The old subject of the "Coal Resources of the United Kingdom" was recently treated by Mr. Arnold Lupton, before the South Wales Institute of Engineers; but, although the question is an old one, there was a good deal in the contribution that had a freshness about it. One of the points that can be so classified is where the author dealt with the effects of the combustion of fuel upon the atmosphere.

In this connection, he remarked: It is a question of some interest as to how far the continued combustion of mineral fuels will so alter the quality of the atmosphere we breathe as to lower the vitality of the human race as at present constituted. If this change in the atmosphere is likely to take place, it is highly improbable that in the short space of time in which it will occur—say, 1000 years—the human body will have had time to adapt itself; but the following calculation seems to show that we shall probably still be able to breathe when all the fossil fuels in the world have been burnt up.

One pound of carbon requires 2·67 lbs. of oxygen or 12 lbs. of air for complete combustion. The weight of air on every square inch of the surface of the globe is rather more than 14 lbs. The total weight of coal, adding to it oil, mineral gas, and peat, is (say) 8,000,000,000,000 tons; and, assuming that eight-tenths of the total weight is carbon, this gives us a weight of 6,400,000,000,000 tons of carbon, requiring twelve times that weight of air for complete combustion. The superficial area of the globe is about 453,000,000 square miles. Then the ratio of the weight of air

burnt when all the mineral carbon is consumed to the total weight of the atmosphere is shown by the following calculation, which the writer thinks is approximately accurate:

$$\frac{\text{Square Miles.}}{453{,}000{,}000} \times \frac{\text{Acres.}}{640} \times \frac{\text{Sq. Yds.}}{4840} \times \frac{\text{Sq. Ft.}}{9} \times \frac{\text{Sq. In.}}{144} \times \frac{\text{Lbs.}}{14} = \frac{148}{1}$$

$$\frac{\text{Tons.}}{6{,}400{,}000{,}000{,}000} \times \frac{\text{Lbs.}}{2240} \times 12$$

That is to say, the total atmosphere is 148 times the amount required for combustion, and the burnt air will be 0·68 per cent. of the total, the weight of carbonic acid gas about 0·3 of the total weight of coal and burnt air, or $0{\cdot}68 + 1\frac{1}{2} =$ say, $0{\cdot}74 \times 0{\cdot}3 =$ 0·222 per cent. of the total atmosphere. The Mines Regulation Act allows 1·25 per cent. or six times as much.

There is, therefore, nothing to fear from the carbonic acid gas in the air, so long as present meteorological conditions prevail, and there is plenty of wind to keep mixing the air up and moving it about the world.

A HOME-MADE COKE-CONVEYOR.

A home-made labour-saving device for handling coke, which has been installed at the Walla Walla gas plant of the Pacific Power and Light Company is described by Mr. L. W. Allison in "Gas Age" (New York). The arrangement, which is simple and effective, was designed primarily to facilitate the loading of cars which are run to the sheds on a trestle about 6 feet above the ground; and it has proved highly ecomomical in operation, with considerably reduced labour and loading costs, in addition to being economical from the point of view of installation cost.

The conveyor, built in the form of an endless chain, is constructed of wood, being about 30 feet long and 18 inches wide, with two side timbers 10 inches high. It is fastened on two heavy grooved planks nailed to a platform 6 feet square, and placed on a suitable incline from the ground to overhang the car-trestle. The platform serves as a ground-base for the shoot, and it also allows for raising and lowering to suit the different car elevations, as may be required. Sprocket wheels are provided at both ends of the shoot to carry two endless chains, one at either side; and 4-inch hardwood strips are fastened on edge to the links of the chain at distances of about 10 inches apart. A piece of galvanized sheet iron is attached at the bottom of the wood cross-strips, to form a bucket for carrying the coke.

The shoot is operated by means of a 2 H.P. motor, placed on the platform, which is belt-connected to a 40-inch pulley fastened to a shaft located about 15 feet from the ground end of the conveyor. A sprocket wheel fitted on the opposite end of the shaft carries an endless chain to a larger wheel at the upper end, reducing the operating speed to about 280 revolutions. This speed has been found the most efficient for practical service in continuous operation—requiring two men for loading for delivery to a car.

By the use of the conveyor, it is said to be quite possible to load a car with coke in three hours, as compared with the necessity of using four men with wheelbarrows an entire day. The device was constructed by the local staff of the Company at Walla Walla, under the direction of Mr. C. S. Walter, the Manager.

Institution of Mining Engineers.—The annual general meeting of the Institution will be held at the Royal Technical College, Glasgow, on Thursday of next week. Two papers will be presented by Mr. J. Ivon Graham, one on the "Permeability of Coal to Air or Gas, and the Solubilities of Different Gases in Coal," and the other on the "Formation of Water in the Oxidation of Coal." There will also be a communication by Mr. David Ferguson on the "Form and Structure of the Coalfields of Scotland;" and, in addition, several papers (including three by Mr. T. F. Winmill, B.A., B.Sc.) which have already appeared in the Institution's "Transactions" will be open for discussion. During the afternoon there will be a reception by the Lord Provost and Corporation of Glasgow, and for the following day there has been arranged an excursion by steamer down the Clyde.

Coke-Ovens and Natural Gas in Canada.—A report on the mineral production of Canada in 1915 has recently been issued by the Mines Branch of the Canadian Department of Mines. In the section of it dealing with coke-ovens, it is stated that the total output of oven coke last year was 1,200,766 short tons, made from 1,856,393 tons of coal, of which 1,425,172 tons were of domestic origin and 431,221 tons were imported. The bye-products from the ovens, which included 10,448 tons of ammonium sulphate, 7,365,931 gallons of tar, and 4089 million cubic feet of gas, made in 1915, were in excess of the production in 1914. There was also for the first time a production of benzol and associated compounds. The production of trinitrotoluene near the close of the year was reported as 100,000 lbs. per week. Complete returns had not at the time of writing the report been received from some of the largest operators in the natural gas fields in Ontario. The 1915 production of natural gas (subject to corrections of the estimates used) was approximately 18,319 million cubic feet, valued at $3,300,825. The production of the previous year was reported as 21,692 million cubic feet, valued at $3,484,727, of which amount Ontario produced 14,094 millions, valued at $2,215,808; New Brunswick, 426 millions, valued at $54,249; and Alberta, 7172 millions, valued at $1,214,670.

RELATIVE STRENGTH OF WELDED AND OF SCREWED PIPE JOINTS.

The results of some tests made on welded and screwed pipe connections of equal sizes, and on sections cut from the same lengths of pipe, are published in "Iron Age." The specimens used were supplied by the Oxweld Acetylene Company, of Chicago, and were cut from standard weight black pipe made by the National Tube Company, who also made all the welds. They included two pieces of the original pipe, each 18 inches long, except the 2-inch, which was supplied for the compression test in 5-inch lengths, four butt-welds (the edges of the pipe being cut to a bevel of 60°), two malleable iron screwed connections, two welded tees, 18-inch stem and 15-inch branch, and two fittings of similar dimensions, made up with ordinary malleable screwed tees.

The tee welds were made by cutting a hole of proper size on the stem, and butting the branch against it. The sizes tested were ½-inch, ¾-inch, 1-inch, and 1½-inch for tension, and 2-inch for compression. The results were as follows:

For Tension.	Welded.	Screwed.	Relative Strength (Screwed = 100).
½ inch pipe	10,222	9,040	113
¾ "	21,367	13,835	154
1 "	28,330	17,230	164
1½ "	43,975	31,270	140
½ inch tees	12,903	8,723	148
¾ "	19,763	12,303	160
1 "	30,007	17,550	171
For Compression.			
2 inch pipe	72,500	58,150	125

In most cases the welded tee connections broke at some distance from the weld, and on the branch; while all screwed fittings broke in the casting. The elastic limit of the pipe was the same, whether welded or screwed—showing that elasticity was not affected to any appreciable extent by welding. The screwed couplings broke without elongation, on account of the reduced cross section of the screw threads. Diagrams are given, showing that the cost of the screwed connections ranged from 4 c. for ½-inch to 47½ c. for 4-inch pipe, and that of the welded, from 2½ c. to 30 c. Screwed tees range from 7½ c. to 110 c., and welded tees from 5 c. to 45 c.

Sweden and Thorium Nitrate.—The Swedish Chamber of Commerce for the United Kingdom are in receipt of a cable from the Swedish Board of Trade, Stockholm, to the effect that thorium nitrate has been added to the list of goods which are now prohibited for exportation from Sweden to all countries, and also in transit through Sweden.

Gas Engineering and Supply Classes in Birmingham.—The programme has been issued of forthcoming special classes in gas engineering and gas supply at the Birmingham Municipal Technical School; and we are glad to note the efforts that are being put forth this year to make these classes as large as possible, in view of the fact that the supply of well-trained young men on the works is so much reduced. The courses are intended to prepare candidates for passing the examinations held by the City and Guilds of London Institute. In "Gas Engineering," the lecturers are Mr. E. W. Smith, M.Sc., and Mr. W. J. Pickering; while the lecturer in "Gas Supply" is Mr. W. G. S. Cranmer. The session opens on the 18th inst.

Exports of Carbide of Calcium and Coal Products.—The Customs and Excise Department have just issued their annual report as to the trade of the United Kingdom with foreign countries and British possessions in 1915. Each product is specified separately, together with the extent of the trade done with the more important countries—the corresponding figures for 1914 being in parentheses. The exports of carbide of calcium were to Sweden, 81,883 cwt. (119,237 cwt.); Norway, 366,938 cwt. (359,126 cwt.); Italy, 23,318 cwt. (93,910 cwt.); other Foreign Countries, 10,345 cwt. (3170 cwt.); Canada, 39,039 cwt.; total, 521,523 cwt. (575,443 cwt.). The figures for coal products, not dyes, were to Germany, 6000 cwt. (31,956 cwt.); Netherlands, 9806 cwt. (589 cwt.); Belgium,— (2969 cwt.); France, 623 cwt. (3592 cwt.); United States, 6142 cwt. (4915 cwt.); other Foreign Countries, 5645 cwt. (7526 cwt.); British possessions, 25,938 cwt. (80,231 cwt.); total, 54,154 cwt. (131,778 cwt.).

National Insurance (Part II.) (Munition Workers) Act, 1916.—The Umpire has decided that contributions are payable in respect of smiths, stampers, piercers, and other workmen engaged in general odd work on metal goods; also workmen engaged in the manufacture of all classes of bricks, including silica bricks and fire-bricks, whether moulded or formed by hand or by machinery. The Board of Trade have by order, as empowered by the Act, excluded from insurance under it various classes of munitions work, among them the classes of work defined in paragraphs (*b*), (*c*), (*d*), and (*e*) of section 9, of the Munitions of War Act, 1916 [including work on buildings, docks, or harbours, the supply of light, heat, water, or power, or tramway facilities, and the repair of fire brigade appliances, when these are certified as necessary in the national interest]. If any class of work is insurable otherwise than as munitions work, the order does not have the effect of excluding it from insurance.

REGISTER OF PATENTS.

Manufacture of Gas.

ANGLO-MEXICAN PETROLEUM PRODUCTS COMPANY, LIMITED, and BROUSSON, R. P., of Finsbury Court, E.C.

No. 6873; May 7, 1915.

The patentees propose to mix bitumen derived from the distillation of petroleum with coal in suitable proportions and treat the mixture in retorts in the way coal is ordinarily treated, whereby there is said to be obtained "a greater output of gas than can be obtained from a corresponding amount of coal alone, and even from corresponding amounts of coal and bitumen treated separately in retorts."

Regarding their proposal the inventors remark: Bitumen derived from the distillation of petroleum differs from natural bitumen in that the percentage of ash or foreign matter is very small; that a small proportion in admixture with coal largely increases the yield or quality of gas; and that the coke is not detrimentally affected by its use. These differences are of great importance, since the addition of a large proportion of either kind of bitumen would render the carbonization process impracticable under the usual conditions obtaining in gas-works, and deterioration of so valuable a bye-product as coke would largely reduce the advantage due to increased yield or quality of gas.

The bitumen preferred is produced by carrying the normal petroleum distillation process to a further stage than is usual for the production of bitumen—viz., to about 750° Fahr., or to such a temperature as will produce a bitumen which, on cooling, becomes a hard black mass that is brittle or capable of being readily broken either by hand or in an ordinary coal-cracker, and is refractory in the sense that the temperature required to completely carbonize it in the retorts, though probably somewhat lower, will approach more or less closely that required to carbonize the coal.

In carrying out this invention, the desired proportion of bitumen (reduced, if need be, to the required size) is thoroughly mixed with the coal to be carbonized, the mixture being made before charging into the retorts, and the gas making conducted as usual—care being taken that the temperature of carbonization is not too low, and that sufficient space is left above the charges in the retorts for fixing the gases.

The proportion of bitumen may be varied according to particular requirements and qualities of coal used. The patentees have found that, with charges comprising 95 to 92½ per cent. of good quality coal and 5 to 7½ per cent. of bitumen, the output of gas per ton was considerably increased—the candle power or calorific value being maintained substantially the same. The yield of gas obtained from the mixture is said to be considerably more than the yield of gas from corresponding amounts of coal and bitumen carbonized separately. Although higher percentages of bitumen may possibly be used with advantage, their experiments "indicate that high percentages of bitumen will not give correspondingly high yields of gas. Moreover, it should be borne in mind that with high percentages of bitumen difficulties may occur, such as excessive flame or flare during charging, and deposit of liquid bitumen at the cooler ends of retorts of the horizontal type."

In cases where it is desired that the illuminating power or the calorific value of the gas shall be high for the quality of coal used, the conditions under which the mixture of coal and bitumen is carbonized are regulated in a similar manner to that usual in the manufacture of gas from coal when a rich gas or a gas of high calorific value is required.

The invention "renders available to gas makers a method of enriching or increasing the output of an ordinary coal-gas works which is cheap, simple, and effective, and is capable of increasing the output to meet a sudden demand due to fog or other cause. Furthermore, the coke resulting from carbonization of the mixture is not poor, but of good physical quality. The cost of the preferred bitumen delivered at the works should not be excessive, as it can be transported in bulk at low cost, and, in the works, it can be largely handled in the same way, by the same men and machinery, and submitted to the same treatment as the coal; so that the process of gas making is not unduly complicated by its use.

Valves.

BLAKEBOROUGH, R. A., and BROADHEAD, J. B., of Brighouse.

No. 13,358; Sept. 20, 1915.

This invention relates to valves having two discs which are forced into engagement with their respective seatings by wedging action on closing the valve or when the valve is completely closed.

The wedge blocks—supported between the two discs comprising the valve, and having their upper ends recessed to provide wedge surfaces for a wedge formed on the lower end of a nut on the valve-spindle, or on a sleeve carried by a nut on the spindle—have extended from them members whose lower ends are inclined outwardly or diverge from each other at suitable angles at each side of the centre of the valve, and so are adapted to engage at their extremities with projections on the valve-casing.

Discharging and Quenching Coke.

WELLINGTON, S. N., of Mincing Lane, E.C.

No. 16,108; Nov. 15, 1915.

This apparatus for discharging coke from vertical retorts and quenching it, is more especially applicable to coke produced at comparatively low temperatures. The invention has for its object "to avoid waste in discharging, to improve the coke, and also to quench the coke without contact with the water used."

The discharging mechanism (mounted upon a carriage frame running on rails) comprises one or more rams adapted from beneath to pass through the receptacles to take the weight of the bottom cover plate or door of a retort, and to lower the plate with the charge from the retort into the corresponding receptacle. The mechanism comprises an electro-motor and controller with a clutch for driving the carriage upon which the mechanism is mounted to run or for lifting or lowering the rams; also means manually operated by which the exact adjustment of the position of the rams and carriage may be effected with reference to the receptacles and retorts.

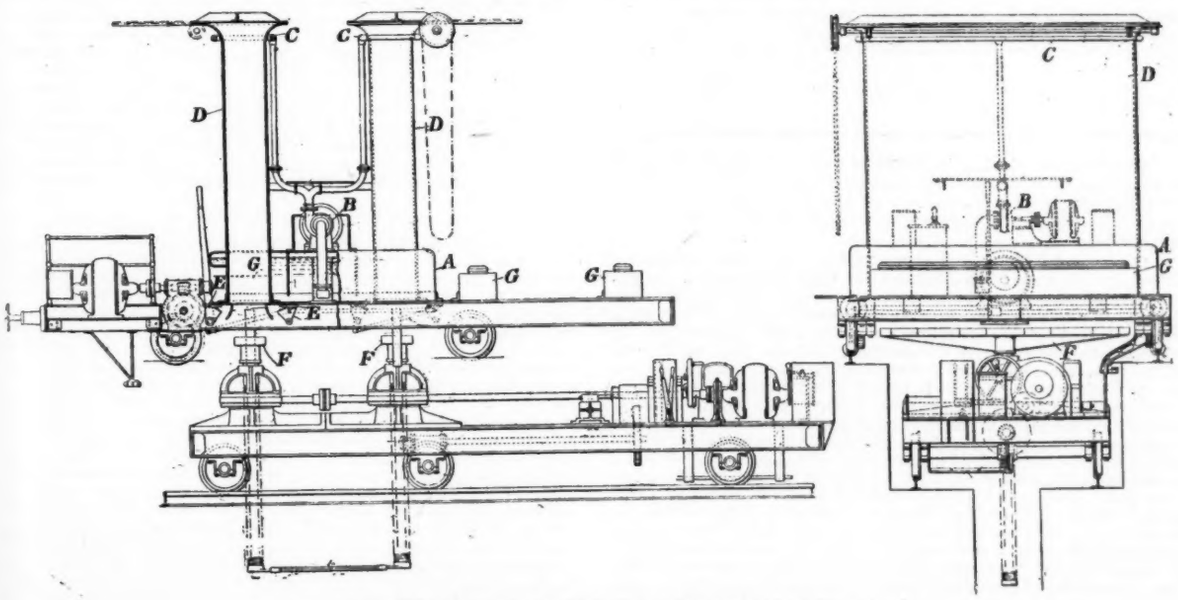
A side elevation (partly in section) of the apparatus and an end elevation are given.

Two receptacles D are mounted upon a carriage frame in such position that two alternate vertical retorts of a battery may be discharged simultaneously. Each receptacle is provided with a sliding cover plate, beneath which toothed racks are mounted to mesh with pinions mounted upon spindles carried immediately beneath and near the side of the outwardly flaring upper end of each receptacle. A chain wheel and chain are used to rotate the spindle, and thus cause the cover plate to slide to or fro for closing or opening the top of each receptacle.

Upon the carriage frame is a tank A to contain water for quenching the receptacles D, the lower ends of which pass into the tank; so that at their lower ends the receptacles are completely surrounded by the water contained in the tank. There are holes in the top of the tank, so that on water being sprayed from the upper end of the receptacles on to the outer surface the water returns to the tank.

A pump B and motor are mounted above the tank with a suction pipe extending to near the bottom of the tank and with its upper end connected to the pump. The pump discharges into the pipes by which water is supplied to spray pipes C (which completely surround the receptacles D), provided with orifices throughout their length through which water is directed inwardly towards the outer surface of the receptacle.

Each of the receptacles D at its base and on each side is provided with a sliding plate E provided on each side with toothed racks engaging with segments. The inwardly protruding edges of the plates are formed with curved downwardly flaring flanges, which serve to



Wellington's Apparatus for Discharging and Quenching Coke.

bring the respective rams F on their upward movement into exact coincidence with the centre of the respective receptacles D.

Thus the bottom doors G of the retorts to be discharged are retained with the charge in the receptacles D. For this purpose the carriage frame is extended at one end in order that two spare doors may be transversely mounted in position thereon corresponding to the position of the retorts; and these, after the discharge of the retorts, may immediately be lifted into position to close them, so that the empty retorts may be immediately re-charged—the respective doors being retained in the receptacles upon the inwardly protruding edges of the sliding plates until the receptacles themselves are discharged.

In operation, on the discharge of the retorts, the rams are lifted through the receptacles D, and the weight of the respective doors G, with the charge upon them, is then taken by the rams. The doors are then releaeed, and the doors and charges are lowered into the receptacles upon the rams. The covers are then closed, and the motor and pump set into operation for quenching the charges therein.

Destructive Distillation and Carbonization of Peat.

PATERSON, E. A., of Thorold, Ontario, Canada.

No. 12,003; Aug. 19, 1915. No. 2530; Feb. 19, 1916.

This combined invention relates to improvements in processes for the preparation of peat for fuel, or for destructive distillation and carbonization, in which an alkali is first added to the peat to neutralize its acidity and then a suitable silicate before it is dried for use. The invention consists in the combination of steps constituting the method of preparing the peat.

It is first treated in any suitable manner to remove certain of the superfluous water—say, about 20 per cent. This initial operation may conveniently be effected by means of a press or by other apparatus—for instance, such as is used for the treatment of pulp in the manufacture of paper. Or, if desired, heat could be used to drive off a certain quantity of the superfluous water before the peat is pressed or in substitution for such pressure. The resulting material may be then disintegrated in any convenient manner; and for the purpose of neutralizing the acids, if any, contained in it, a suitable amount (say, about 2 per cent.) of alkaline material may be mixed with it as an alkaline earth compound, such as carbonate of lime.

After the acids, if any, have been thus neutralized, there is added from 1 to 3 per cent. of an alkali-metal silicate such as silicate of soda either as a liquid (of a gravity of about 80° Twaddel) or as a dry soluble powder. The material is then intimately mixed in a pug mill, and after being moulded into brick or other suitable form it is dried, preferably in the air, until 50 to 60 per cent. of the remaining water it contains is driven off. The drying operation can conveniently be facilitated by passing the bricks through some form of dryer at a comparatively low temperature. The dryer may take the form of an endless belt upon which the bricks are arranged, and preferably such as is described in patent No. 10,670 of 1915.

By this drying process the combined water is freed by the action of the silicate of soda in the presence of the carbonic acid; and the resulting product, when completely dried, takes the form of a hard, black mass, which is thus obtained without the use of pressure, "thereby dispensing with an expensive step in the manufacture of peat for fuel, and its preparation for retorting."

To economize in the use of the silicate of soda, in some cases there may be added thereto a weak solution of some other substance—such as boracic acid in suitable proportion—which will result in the formation of borate of soda and silica. Or, instead of this solution, a part of the acid may be replaced by calcium chloride—say, from 1 to 3 grammes of boracic acid may be dissolved in 100 cc. of hot water, and 30 cc. of the solution are stirred into 100 cc. of silicate of soda solution of about 72° Twaddel. If a slight precipitate forms, heat should be applied until it is redissolved. The strength of the resulting solution should be about from 52° to 55° Twaddel.

In order to further economize in the use of boracic acid, part of the acid may be replaced by calcium chloride. In this case, the patentee proposes to mix together with the boracic acid calcium chloride and a solution of silicate of soda—preferably proceeding as follows: 1 to 3 grammes of boracic acid are dissolved in 100 cc. of hot water, and 1 gramme of calcium chloride is dissolved in the solution. Then 4 cc. of the solution are stirred into 130 cc. of silicate of soda solution of 52° to 55° Twaddel and slightly heated. Borate of soda, silicic acid, and calcium hydroxide are formed in the solution of silicate of soda.

Consumption of Gas in Bradford.—The Bradford Gas-Works management have come to the conclusion that, apart from the saving on street lighting, there is in progress an economy of gas amounting to between 5 and 6 per cent., notwithstanding the increased use in munition works.

Nine Per Cent. Increase at Tonbridge.—The results of the past half-year's working at Tonbridge have been satisfactory; the consumption of gas showing an increase of 9 per cent., and the revenue of £2431. In the report submitted at the recent meeting, it was stated that the balance of revenue account was sufficient to pay the dividends recommended, at the rates per annum of 12½ per cent. on the "A" stock, 9½ per cent. on the "B," "D," and "E" stocks, and 5 per cent. on the "C" stock. Mr. W. Judd (the Chairman) pointed out that twelve months ago they had not sufficient by £150 to pay the dividend; but now, owing partly to the increased consumption and partly to the higher price charged for gas, they were, in spite of the high cost of coal, able to pay the full dividend on a reduced sliding-scale. They had at present in hand stocks of coal equal to a supply for three winter months. Very great assistance had been received from the Board of Trade, through whose help they had secured a reduction in the price of coal equal to 3s. 6d. per ton on a contract for 3000 tons. The Directors appreciated the help of the Board of Trade and the assistance of Mr. J. Donaldson (their Engineer), without which this result would have been impossible. At a subsequent extraordinary meeting, the Directors were empowered to make application to the Board of Trade for a further Provisional Order.

MISCELLANEOUS NEWS.

GAS UNDERTAKINGS AND COAL PRICES.

To-Day's Deputation to the Board of Trade.

Referring to the deputation from municipal gas and similar undertakings which is to wait upon Mr. Runciman at the Board of Trade to-day, the "Manchester Guardian" last Thursday said:

The conference is the result of the meeting of representatives of municipal gas undertakings which was held in the Manchester Town Hall on May 18 last. This meeting, it will be remembered, was convened by Alderman Kay (the Chairman of the Manchester Gas Committee) and Alderman Phillips (the Chairman of the Salford Gas Committee), with Mr. F. A. Price (the Superintendent of the Manchester Gas Department) as Honorary Secretary. Strong protests were then made against advances in coal prices beyond those laid down by the Government shortly after the outbreak of war. Following the Manchester meeting, there was a conference of members of Parliament (Sir George Toulmin in the chair) and a representative committee of chairmen and officials of gas undertakings in the House of Commons on Aug. 10, when it was decided to seek an interview with the President of the Board of Trade, with a view to an amendment of the Coal Price Limitation Act of 1915, and the "removal of the grievances under which coal consumers now labour." At this forthcoming interview with Mr. Runciman, the presence of the Minister of Munitions has been requested, seeing that he is really interested as a large consumer of coal, having regard to the maintenance of the supply of gas to munition works, and also the supply of high explosives. Sir George Toulmin, M.P. (Bury), Mr. E. R. Bartley Denniss, M.P. (Oldham), and Mr. G. J. Warde, M.P. (Stockport), have arranged for the deputation to be received by Mr. Runciman. Of course, the immediate reason for seeking Government intervention is the leave recently allowed the South Wales coalowners to raise their pit-head prices of coal 2s. 6d. a ton. The deputation will protest against this, and against any further allowance of a like nature being agreed to by the Board of Trade.

BRIGHTON AND HOVE GENERAL GAS COMPANY.

The Half-Yearly Ordinary General Meeting of this Company was held on Friday, at the Offices, No. 5, Great Winchester Street, E.C.—Mr. A. M. PADDON, M.Inst.C.E., the Chairman, presiding.

The SECRETARY (Mr. E. L. Burton, F.S.A.A.) read the notice convening the meeting; and the report and statement of accounts were taken as read.

THE DECREASED CONSUMPTION ACCOUNTED-FOR.

The CHAIRMAN said that the decrease in the output of gas as compared with the same half of the previous year, referred to in the report [3·2 per cent.], would have been very regrettable, were it not for the fact that the causes were ascertained and definite. A year ago, incidental to the formation of the camp at Shoreham, there was a large accession of population in the Company's district of supply. At one time, some 17,000 soldiers were in the camp; and, of course, this did not represent the total additional number of persons involved. But in 1914 the arrangements made for the housing of the soldiers were not satisfactory, and during the winter months they were drafted into Brighton in billets, thus bringing grist to the mill of the Gas Company. These men afterwards returned to the Shoreham camp, and the accession of business had not again occurred. This exactly accounted for the decrease in the output.

THE PRICE OF COAL AND GAS.

The report next referred to the important advance in the price of coal, and the even more striking advance in the price of oil. The Company had been obliged, for the second time, to increase the price of gas 3d. per 1000 cubic feet, thus making the total rise 6d. In view, however, of all the circumstances, this increase might be characterized as a normal one. The Summer Time Act was referred to in the report more or less prospectively, because the effect of the Act was being more felt during August, and would be experienced in an increasing degree in September. During the days of maximum hours daylight, the influence of the Act was not so great; but in the two months he had named, a very considerable effect would be recorded on the output of gas companies.

FIGURES FROM THE ACCOUNTS.

Turning to the accounts, the total capital receipts stood at £703,379. This was equivalent to £470 per million cubic feet of gas sold per annum—a satisfactory figure, and only £3 in excess of twelve months ago. This slight addition was accounted for by the decrease in consumption. During the half year they had limited themselves to an expenditure of £2779 on meters, and had wiped this out, with a little to the good, by depreciation to the extent of £2913. The amount of capital redeemed was stated at £7375; and there was a balance on capital account of £64,369, which had not a concrete existence, by reason of the counter figure shown in the balance-sheet referring to prepayment meters, stoves, and fittings. In the revenue account, the total receipts from gas, meters, stoves, and fittings amounted to £2512 more. For meter-rental, there had been received £227 more, which was gratifying, as showing that the expansion of the business was still going on in the amplification of the number of consumers. Residuals were up £2296, and the total receipts £4970. The sale of gas per ton of coal carbonized had amounted to 13,632 cubic feet, which he believed was the highest figure that he had had the pleasure of reporting to the proprietors. It was a very creditable result; but the Portslade works had always enjoyed an enviable record in this matter. Another satisfactory figure was that the unaccounted-for gas, together with that used on the works, amounted to 3·89 per cent. When it was considered

that the Company were distributing gas under conditions comparatively disadvantageous, in the matter of extent of district, it would be agreed that the figure was a very good one. On the debtor side, coal had cost £11,866 more—nearly 4d. per 1000 cubic feet of gas. As a matter of fact, the price was up by 4s. 6d. per ton; and they were not by any means yet at the end of this trouble. There had been carbonized 2094 tons in excess of the corresponding quantity; but this, of course, was almost entirely due to the fact that the Company manufactured less carburetted water gas. Maintenance charges had always been ample in the case of this Company—sometimes to the extent of evoking criticism; but it was only by keeping up these charges that it was possible to retain a thoroughly healthy state of affairs. Superannuation of officers was a new item, amounting to £780; and it would perhaps be impressive, were it not for the fact that in the item of engineers and other officers at works there was a reduction of £692. To a certain extent, one set-off the other. A footnote explained that the expenditure included £4873, or over 1½d. per 1000 cubic feet of gas, for allowances to employees by way of bonus, special bombardment and aircraft insurance, allowances to dependants of those who had gone to serve their country, &c. This was, however, an outlay which no proprietor would desire to truncate. They were promoting their own interests in supporting national interests; and he hoped that one lesson the war had taught them all was that the two things were identical. The total expenditure was £9299 in excess of last year; the receipts were £4970 more; the profit was £4329 less. For interest, income-tax, and dividend, they needed £27,036; and the profits, *plus* a small sum for interest on money at the bank, came to £26,345. Thus they were, on the whole transaction, just £691 short.

CAPITAL REDEMPTION FUND.

As to the capital redemption fund, the principle underlying this account was in abeyance. The circumstances under which it was formed had passed temporarily out of existence. When it was instituted, it was a new proposal before Parliament, and was designed to meet the special case of the Company. They had a large margin of manufacturing and distributing plant, and therefore a larger capital per million cubic feet than they desired to see; and the business did not increase in the rapid way that some kinds of industries did. It was desired to bring the price of gas down as quickly as possible; and this was a thing which could not be done in any permanent or sustained way while the capital per million remained up. The essential thing before supplying continuously cheap gas was to get the capital per million down; and there were only two ways of which he was aware in which this could be done. One was by increasing the business and refraining from raising fresh capital, and the other was by extinguishing capital which existed. If the business did not increase, by reason of special circumstances, the first alternative was barred; and without parliamentary powers, the second alternative was barred, also. The Company got Parliament to consider the matter; and, in spite of opposition, they agreed that the principle was sound. The aim of this proposal was, taken in conjunction with the increase in the business, to bring the capital down to a point which would justify them contemplating selling gas at a steadily low price in Brighton. The effect of these powers—and he thought he was rather responsible for the innovation—was that in a very few years they had wiped out one-sixth of the issued capital, and got down to a figure which allowed them to sell gas at the low rate of 2s. 8d. per 1000 cubic feet, not only with the prospect of maintaining it at that level, but with the hope of further reducing it. Then came the "bolt from the blue." The war, with the rising cost of materials, upset the whole of these circumstances, and revolutionized everything; and this fund immediately became inoperative, because the principle disappeared. If, however, it had not been for the few years in which they were able to put the powers into force and reduce the capital, they could never have passed through the recent anxious months with the measure of success that the Board were able to report. He believed it to be a good principle, and one of the best provisions the Company had in their Acts.

TRADE POLICY OF GAS UNDERTAKINGS.

Brighton, of course, was to a certain extent exceptional as an area of gas supply. It was not industrial; but it might be said broadly to reflect the general condition of the country. It had one great advantage which could never be taken away from it—that of being the point at which the sea was closest to the Metropolis. This would always be a great asset. Now as to another matter. It had become a duty incumbent on gas and all other industrial undertakings to forget a little of what things were before the war, and to realize that they were units in the general commercial community of the country, and should do everything to promote the general prosperity which they hoped to share. When the war broke out, they found themselves face to face with many difficulties which they could not have either foreseen or avoided; but they also found themselves concerned with other matters which were largely dependent upon foolish principles, mistaken ideas, and bad practices. When they wanted mantles, glass chimneys, brass fittings, &c., after the war broke out, they found their deadly enemy was in possession of supplies of these goods which they could not obtain. The English industries could make these things as well, or even better, and, if they were treated fairly, cheaper than the foreign supply; but this country had been content to feed out of the hand of the foreigner. If all the money that had gone abroad had been spent in the Midlands, there would have been a better state of things throughout this country. But at least they could learn from experience to protect themselves from again falling into the miserable error of depending upon those with whom they were now at war for goods they needed in their business. In order to assist the industries of this country, the Directors had decided to adopt a certain attitude with regard to the purchase of supplies. As a result of the war, large factories had been put up all over the country; and it would be a vast problem to keep these going when the war was over. People could not go back to the old practice of getting things from abroad while these men who had done everything for them were without employment. Therefore, let them admit their past follies, face the thing boldly, and determine to allow the people here to produce what they wanted. There would be an urgent need of work for Englishmen, who could do it as well as, or better than, others. This being so, the Directors had passed the following resolution:

1.—That the Company shall have prepared a list of manufacturers, contractors, purveyors, agents, and traders for the supply of commodities, appliances, goods, and materials to the Company, and the Company shall not purchase any supplies as described without the special consent of the Directors except from the traders on such list as amended or enlarged from time to time by order of the Directors.

2.—That any firm of traders belonging to, directly or indirectly obtaining any material or any manufactured articles from, or in any way connected with, any nationality now at war with Great Britain or her Allies, shall be excluded from the said list.

3.—That business shall not be transacted with traders of neutral nationality except where such transactions cannot be effected with equal advantage to the Company with firms whose names are on the said list.

4.—That no trading firms of British or allied nationality, competent to supply the requirements of the Company, shall, without good and sufficient reason, be excluded from the said list.

In this way, they felt they would contribute to the future welfare of those with whom they did business; and they believed that, if this principle were generally adopted, industrial prosperity would ensue, in which gas undertakings would have their share. He concluded by moving the adoption of the report and accounts.

The DEPUTY-CHAIRMAN (Mr. G. W. Carey) seconded the resolution; and it was agreed to without discussion.

On the proposition of the CHAIRMAN, seconded by Mr. A. F. PHILLIPS, dividends were declared for the half year at the statutory rates per annum of 6 per cent. on the "B" and 4 per cent. on the "C" preference stocks, and 10¾ per cent. on the original and 7¾ per cent. on the "A" ordinary stock.

The CHAIRMAN proposed a vote of thanks to the executive officers; referring in complimentary terms to the technical and scientific attainments of the staff.

Mr. C. HARRIS seconded the vote, which was cordially passed, and responded to by

Mr. BURTON and Mr. C. H. RUTTER (the Engineer and General Manager). Mr. Rutter mentioned that the Company had lost 472 men from a total of 863, or practically 55 per cent. The percentage of killed, wounded, and missing was very small, he was glad to say; so they might hope to see the bulk of the men back. In the meantime, in various occupations women were doing excellent work for them.

Mr. HARRIS proposed a similar vote to the Board, and expressed his pleasure at hearing the Chairman's declaration of policy on the question of the purchase of British goods.

Mr. F. PILLEY referred to the great debt of gratitude the proprietors owed to the Directors.

The meeting closed with the CHAIRMAN'S acknowledgment.

LEA BRIDGE DISTRICT GAS COMPANY.

The Ordinary Half-Yearly General Meeting of the Company was held last Tuesday at the Offices, Nos. 63 & 64, Chancery Lane, W.C.—Mr. A. M. PADDON, the Chairman, presiding.

The SECRETARY (Mr. Richard Sandell) read the notice convening the meeting; and the report of the Directors and the statement of accounts were taken as read.

INCREASED BUSINESS.

The CHAIRMAN, in moving the adoption of the report and accounts, said the most satisfactory feature was the fact that they had succeeded in increasing their business during the past six months. Not a very great number of gas companies had been able to do this. The explanation was that their own district was partly an industrial one, and therefore shared in some of the activities promoted by the preparation of war material. It was also, he thought, partly due to the very excellent relations between the Company and the consumers which had been built up over a large number of years by Mr. F. W. Cross, their Engineer and General Manager.

PRICE OF GAS AND RAW MATERIALS.

The report told them that the dividend was maintained at the figure last paid, and that the Directors had been obliged to increase the price of gas by 2d. per 1000 cubic feet, in addition to what had already been done in this direction. This increase, however, dated from July 1; so that it did not at all affect the present accounts. The total increase in the price of gas was 4d., making the charge 3s. 3d., which there was every reason to believe would meet all requirements as they presented themselves. This rise of 4d. was only 11 per cent. on the price before the war; and when they looked to the causes occasioning this increase, they found that the cost of materials had gone up, taking it generally, from 45 to 60 per cent. He was sure they would agree that meeting these demands with an increase in price of 11 per cent. was a very creditable act of administration, and that it had spared the public to the fullest possible extent the consequences of the terrible period through which the country was passing. In a district such as theirs—a poor district, as he might term it—this consideration was a very important one indeed, going very closely to the economy of the home. Turning to the accounts, it would be noticed that they had only £9000 of ordinary capital and some £17,000 of debenture capital to issue; and having regard to the size of the Company, this was a very small margin of unexercised power. It was a matter which occupied the attention of the Directors, with a view to obtaining the powers that would be necessary for securing money to carry out future extensions. The capital issued was £319,910; and, making allowance for the sum added on conversion, this amounted to only £599 per million cubic feet of gas sold per annum. Taking into account their output of gas, he thought this figure was a very favourable one indeed, and one that did not compel them to make undue demands upon the consumers in the way of the

price of gas. It was just this capital per million cubic feet which was the permanent and determining feature of what a company had to ask the consumers to supply them with through the price of gas. There were lots of other causes, but they were transitory. This was the one steady governing and regulating feature in the relations between the company and their consumers. In the revenue account, coal, oil, and coke had cost them altogether £5600 more—equal to well over 5d. per 1000 cubic feet of gas sold. Of this, they had succeeded in getting back 3d. from the residuals; and the increase of 2d. in the price of gas would on the face of it account for the balance. But, of course, there were other increases running all through the accounts; they did not economize on many items in these days. The carbonizing wages amounted to 1·83d. per 1000 cubic feet, which he could not regard as altogether favourable. The fact was, however, that they were in a transition stage at the works. They had not yet succeeded in getting their new carbonizing system into full and regular operation; but when they did, they might hope to see a very considerable improvement in this item. Payments to dependants of men on service and war bonus on wages had cost £811, which was nearly £200 more than a year ago; but he was sure the Board would not be called to account for this. The balance carried to profit and loss account was £8365, or £700 less than for the corresponding period last year. The rental of meters showed an increase of £187, and of stoves £557. Residuals had yielded £3310 more. The gas sold per ton of coal carbonized was 11,844 cubic feet, which, again, was not a satisfactory figure; but it was entirely owing to what was transpiring at the works. Unaccounted-for and used gas was 5·35 per cent., which was, if anything, rather on the good side. For dividend, interest, and income-tax, they required £8552; so that there was a small deficit on the working of £187—not an unsatisfactory outcome, having regard to the fact that the carry-forward of undivided profits closely approached the limit imposed on them by Parliament.

VALUE OF THE WORKING CLASS CONSUMER.

There were anxieties with regard to the future; but they were considerably tempered in comparison with the precariousness of the prospects of some other undertakings, for they were not dependent on sea-borne coal. They had accumulated a very fair amount of coal in storage; and, so far as could be seen, they were not confronted with greater difficulty now than was the case a year ago. As he had already said, the district was an industrial one, which was a very fortunate fact for any gas undertaking to connect with its business. The artizan earning £3 or £4 a week contributed a far larger relative amount of his income to the gas undertaking than a man with £3000 or £4000 a year. Really their commodity was the poor man's necessity. Gas for cooking in the small home was much cheaper to-day than coal, and it was a saving to the workman in many ways, as he knew perfectly well. A municipality fitted up workmen's dwellings to be served with electricity instead of gas; and the workpeople refused to go into them until gas was supplied. In the long run, the decision was bound to rest with the workman; and his decision was in favour of gas. Some of the troubles the industry was suffering from would not pass away. He did not think wages would go back to their former level; and he had come to the conclusion that, from the gas companies' point of view, it was not desirable they should. If they were dependent upon the industrial element of the community, a prosperous and well-paid working population was one of the best things a gas company could have.

IN SUPPORT OF HOME INDUSTRY.

He very much hoped that they had done with the old cheapness, the old bad quality, and the old insecurity of supply. When the war broke out, it found them all dependent for many things necessary to the gas business upon foreign supplies—and, not only that, but upon hostile supplies. He trusted this bad chapter was ended. If, instead of this money being sent abroad, it was distributed among the working classes in England, in producing, even at a slightly higher price, the necessities of English industry generally, they would all be better off, and more prosperous. He hoped this fact would be firmly grasped. Very much of the money that had gone to Austria and Germany as the price of mantles, chimneys, and other things, had been fired back across the trenches at the British Army. He looked for the coming of a saner order of things. The Directors of the Company, at any rate, had determined that, when the war was over, they would buy nothing from the Powers at present in conflict with Britain and her Allies; nor would they buy from neutrals, if they could get the same goods from their own people or those who had shared with them the heavy burden of the great international struggle.

Mr. G. W. CAREY seconded the motion, which was at once carried unanimously.

Proposed by the CHAIRMAN, seconded by Mr. J. M. MILES, dividends were declared, less income-tax, at the rates per annum of 5 per cent. on the preference stock and 6½ per cent. on the ordinary stock.

The CHAIRMAN, proposing a vote of thanks to the executive officers, said circumstances had made further demands upon them in the past half year, which had been met in the same loyal, energetic, and successful way as before by both Mr. Cross and Mr. Sandell.

Mr. E. L. BURTON, who seconded, said that, to be able to charge, as the Directors had, 14d. per 1000 cubic feet for repairs, &c., of the various wasting items, was certainly matter for congratulation. It strengthened the Company enormously. He noticed, too, that the rental from meters, stoves, and fittings amounted to 7d. per 1000 cubic feet. This was a very satisfactory figure.

The vote was cordially passed, and acknowledged by Mr. SANDELL and Mr. CROSS.

The proceedings concluded with a similar vote to the Chairman and Directors for their services, proposed by Mr. BURTON.

Turning-off the Gas Supply at Night.—At a meeting of the Ripon City Council on Monday of last week, the question of the desirability or otherwise of turning-off the gas at the mains during the night was discussed. Several members contended that it was desirable in the public interest that this course should be adopted; and it was decided that it should be done.

BARNET DISTRICT GAS AND WATER COMPANY.

Marking Time under War Conditions—A Tribute to the Women.

The Half-Yearly General Meeting of the Company was held yesterday week, at the London Offices, No. 139, Cannon Street, E.C.—Mr. ARTHUR F. PHILLIPS in the chair.

The SECRETARY (Mr. Ernest W. Drew) read the notice calling the meeting; and the Directors' report and the accounts were presented.

The CHAIRMAN, in moving their adoption, said the half year had been one of considerable anxiety. The Company had had to submit to a further increase in the price of coal, oil, and every material a gas company required for carrying on business. It had been necessary to exercise much diligence to maintain a satisfactory stock of coal. In common with other gas companies, they had during the half year had a considerable diminution in the gas used for public lighting, especially in the summer quarter. With reference to payment for it, he was pleased to say the Engineer came to a mutually satisfactory understanding with the local authorities. The revenue from this part of the business would be still less for the current half year. The curtailment of outdoor shop lighting, and the economy from the Daylight Saving Act, had also tended to reduce the consumption of gas. It was consequently satisfactory to report a slight increase of ½ per cent. over the corresponding previous half year. This indicated how the consumption of gas for cooking and heating was increasing. As to the accounts, no addition had been made to the gas capital, and only £54 had been added to the water capital for new mains. The gas-rental showed a slight increase—being £16,565, against £15,894 in the corresponding half year—due to the price of gas for the Midsummer quarter having been 2d. per 1000 cubic feet higher, and to the slight additional consumption. Products realized £4638, against £3740. On the expenditure side, coal cost £8409, as compared with £7240. Repairs were £2506, against £1642; but stoves and fittings showed a reduction—£1343, compared with £1612. The charges in respect of public lamps had fallen from £511 to £159, owing to the reduced number of lamps lighted. There was a new charge in the accounts of £312 for war bonuses and allowances to employees. The other charges remained much the same; the resulting profit being £4425, against £4061. The revenue from the sale of water was practically the same—£24,396, as compared with £24 493. The domestic supplies were slightly more, but trade supplies were less, and there had been no new buildings. In the expenditure, pumping charges were £2705, against £2378, due to the increased cost of fuel. All the other expenses showed little change; but in this account there was also a charge of £342 for war bonuses and allowances to employees. The balance of profit showed a slight reduction—from £15,393 to £14,655—owing to the increased expenses without any addition to the revenue. After providing the interest on debentures, and transferring £2000 to the contingency fund, the balance standing to the credit of profit and loss was £35,892. The dividends recommended—£9, £8, and £6 6s. per cent.—would absorb £11,866; leaving £24,026 to carry forward. The working had been highly satisfactory; 13,198 cubic feet of gas having been sold per ton of coal carbonized, and the fuel consumption in the retort-house was only 13 per cent. of the coke made. The water delivered for consumption was 389 million gallons, which was 13 millions less than in the corresponding half year. Though some of this reduction might be due to the weather, and to less water being used on the roads, it also showed there was an efficient inspection to prevent waste. The works and plant were in a highly satisfactory condition. He had recently inspected the gas-works and the pumping-stations, and found them in excellent order, highly creditable to the Engineer, and all those who had charge. It was indeed a pleasure to inspect plant so well maintained. The satisfactory results obtained during the half year justified the Directors in the hope that the business would be carried on without any further addition to the price of gas. It should, however, be remembered that only 2d. per 1000 cubic feet was added from Lady-day, 1915; and it was, of course, impossible to say what might take place while this disastrous war lasted. It might have consequences they could not foresee, and which so few were prepared to contemplate. There might be a further advance in the price of coal which might oblige the Directors to reconsider the position. With respect to the staff and workmen, the military necessities of the country had made a further draft on the employees. It would be understood that in an old-fashioned Company, they had a number of elderly men who had been with them many years. Some could look back to about forty years' service, which in itself spoke well both for the employed and the employers. In these times of stress, the happy relations which had always existed between the Company and their employees had been a great asset. It would be of interest to the shareholders to know that, at the outbreak of the war, they had a total of 160 employees, of whom 75 were serving with the Forces. The Company had very properly curtailed their work and expenditure as much as possible; and, at the present time, they had a much reduced staff of men, of whom 95 were under or over military age and ineligible, and, in addition, they had 19 women. In all cases of those serving, the Directors had, as the requirements of each case merited, made allowances to dependants. He desired to take advantage of this opportunity to testify to the good work done by the women in their employ. Having seen women working in many ways, he wished to speak in appreciation of them, and, in doing so, to refer not only to their excellent work in the Barnet Company, but in many other companies with which he was connected. The women of the British Empire were a revelation of which every man in the Empire must be proud. They had shown qualities of self-sacrifice, intelligence, endurance, and perseverance far beyond what in days gone by was expected of them. Whether they saw them in the hospitals devoted to the wounded and sick, or in the camps and munitions works attending to the workers, or in the banks, or the offices of gas-works and like undertakings, or attending to the outdoor departments, they were a grand success—always cheerful, never grumbling, but ever desirous of doing their share in the country's work. They must admire them. And mind this was equally true from the highest women in the land to the daughters of the working classes. The women had shown what they

were capable of doing, and depend upon it they had won for themselves a position from which he hoped no attempt would ever be made to dethrone them. He was, of course, aware that unfortunately there were some whose one aim in life, like some of the men, appeared to be pleasure—theatres, restaurants, and the like—and not giving much thought for the men who were laying down their lives on those awful fields of carnage to save them and their country from the ruthless hands of the enemy. He hoped they were few. He felt sorry for them; and they could ignore them. Though both the indoor and outdoor staffs of the Company were depleted, the Directors and officers would endeavour to maintain the public and private services in the same high state of efficiency as in the past. But should further calls be made on the Company, they might have to ask the forbearance of customers if delay occurred in meeting the numerous requirements of the large population the Company were now serving.

The DEPUTY-CHAIRMAN (Dr. J. W. L. Glaisher, F.R.S.) seconded the motion, which was unanimously carried.

Proposed by the CHAIRMAN, seconded by Mr. ALFRED LASS, dividends were declared, less income-tax for the half year, at the rates per annum of 9 per cent. on the "A" and "C" stocks, 8 per cent. on the "B" stock, and £6 6s. on the "D" capital gas and water stocks.

The CHAIRMAN moved a vote of thanks to the Engineer (Mr. F. J. Bancroft), the Secretary (Mr. Drew), and all the members of the staff. He said that the proprietors would have gathered from the remarks made in proposing the adoption of the report and accounts that the work had been most efficiently done. The Directors, of course, had many anxieties and difficulties with which to contend, but it must be remembered that the officers and those under them had to carry out the details of the work; and this had been exceedingly well done.

Mr. J. E. PLUMMER seconded the motion, which was cordially agreed to.

Mr. DREW, in reply, said the remarks made by the Chairman would be appreciated by all the members of the staff, including the women, who were rather a recent importation. From his knowledge of the accounts at Barnet, he was very proud to be able to inform the proprietors that they were kept as well by the women as they were by the members of the staff who had joined His Majesty's Forces.

Mr. BANCROFT also thanked the proprietors very much for their vote of thanks. It would be greatly appreciated by the staff, including the women, of whom the Chairman had so kindly and gracefully spoken. A considerable number of their staff had left them, and in one section they had only one man remaining; all the rest were girls. They did their work remarkably well. He was glad Mr. Drew had added his testimony, as he had to look after the whole of their accounts. The Chairman's remarks as to the older members of the staff were well deserved. When the Chairman visited the works, he (Mr. Bancroft) showed him more than one man who had been with them for forty years, and who were doing their work as well and strenuously as the youngest of the men. To these men he personally, as well as the Company, owed a debt of gratitude for the way they conducted themselves, and did their work.

On the motion of Mr. L. ANDREWS, seconded by Mr. H. G. HILLS, a hearty vote of thanks was passed to the Chairman and Directors.

The CHAIRMAN briefly replied.

ROAD TAR AND TROUT STREAMS.

The subject of possible injurious effects on fish of the tarring of roads was before the Hampshire County Council at their last quarterly meeting, when the Main Roads and Bridges Committee reported the receipt of a petition from persons interested in the fisheries in the Test Valley. The petition, after stating that those signing it viewed with considerable alarm the proposal to tar the roads in the valley, and desired to register a strong protest against it, proceeded: "It must be admitted that fish-life in several rivers in England has been destroyed by tar having been placed on roads adjacent to the rivers. We are aware it is now considered possible to deal with tar in such a way as to make it innocuous to fish-life, and that it is the practice to construct gulleys by the sides of the roads to act as filter-beds. But there is no doubt that in times of heavy rain or floods these precautions are rendered useless, and the pollution, though it may not actually kill the fish in the river, is sufficient to destroy their natural food, which, in the end, produces the same result. It is sometimes forgotten that pollution is caused, not merely by the tar with which the roads are sprayed, but by the accumulation of petrol and other refuse which is collected on the roads, and with the first storm washed either directly into the river or into the hundreds of streams and ditches which connect with it, and which often form the spawning-beds of the trout and the sources from which their food is obtained. We should be unwilling to suggest that our personal interests should stand in the way of any important public interests; but we do venture to urge that the slight public advantage which might be gained from the tarring of the roads in the district named is not sufficient to justify the risk that would be run, as the fishing in the River Test is really a national asset, and if fish-life in it were destroyed, or materially damaged, it would cause great depreciation in the value of property over a considerable district."

With regard to the petition, the Committee reported that the part affected, so far as the Test Valley was concerned, was the Romsey and Stockbridge main road. They had taken every precaution to use solely tar purified to a very high standard; and they only applied surface tar where the road had been coated with granite or other hard material. When the Committee met the petitioners, some weeks ago, an agreement was come to as to five lengths of road which should not be treated with surface tar for the present. Since the interview, however, the Fishing Association had asked for a further modification as to some portions of the road agreed to be suitable for tarring; and the Committee had directed the County Surveyor to make a further report with reference to these.

In the discussion which preceded the adoption of the Committee's report, Mr. Hendy remarked that he did not think the health of the inhabitants should be sacrificed to the interests of the fish. Those living near to main roads had to close their windows owing to the dust nuisance. Colonel Stratton Bates produced a letter from a Medical Officer stating that tarred roads were healthier than untarred roads, which caused an increase in throat and bronchial troubles. An owner of fish had declared that it was perfectly ridiculous to suggest that tarred roads injured fish. Out of hundreds of trout he had caught, not one was in the slightest degree affected; and those caught were in splendid condition. All the surface water drained into the river, which was the clearest evidence that the tar did no harm. Colonel Bates went on to point out that the fear of tarred roads was very much exaggerated. Captain Seward said the terms in the report were the best that they could get. If the Council caused injury or death to the fish, they would be liable in damages. Where the fishers came into direct conflict with the public, the latter must prevail. Rather than spend money in law or in fighting over the matter, it would be better for all concerned to direct their energies to a peaceful solution of the difficulty by adopting some other substitute for tarring roads. Lord Portsmouth (who is Chairman of the Salmon and Trout Association) referred to the experiments which before the war were being conducted at the Fishmongers' Hall, to ascertain the effect of tar upon the life of trout. He said they had an extremely able and scientific Committee; and the experiments would be resumed as soon as possible. There was no doubt that tar, as they knew it, was deleterious to fish. Of this, they had absolute proof. He agreed that the interests of the public must come first in the long run; but in this complicated question it would be unwise to rush into a dispute which might involve heavy litigation and expenses.

OLDBURY GAS UNDERTAKING.

Manager's Salary Discussed.

At a Meeting of the Oldbury District Council last Friday, there was a long discussion on a recommendation of the Gas Committee that the Manager (Mr. C. H. Carder) be paid £50 by way of remuneration for all extra services rendered by him to June 30, and that his salary be increased by £50 a year, making it £300 per annum, with gas free, from July 1 last.

Mr. E. W. Jackson (the Chairman of the Gas Committee) said at the last meeting of the Council they had an interesting report on the work of the undertaking from the Manager, which he believed every member thought was most satisfactory. So satisfied were they with it, in fact, that they passed a vote of thanks to Mr. Carder for the able way in which he had conducted the affairs of the undertaking. The Committee felt he had done an enormous amount of very trying work, and that he was not only entitled to an honorarium of £50 for the extra services, but also to an annual increase of £50.

Several members (while admitting that the Manager had done good work) disagreed with the granting of an honorarium and an increase at the same time; and it was suggested that if the two recommendations were taken separately, the Council might accept either the one or the other. Mr. Jackson, however, pointed out that the Committee's recommendation was unanimous; and he declined to adopt the suggestion to divide the recommendation into two parts.

A vote was taken, with the result that the whole recommendation was rejected by six votes to five.

THE BUENOS AYRES GAS SCANDAL.

[From "The Times," Aug. 31.]

We drew attention a short time ago to the serious position in which the Primitiva Gas Company had been placed by the action of the Municipality of Buenos Ayres in not paying for the gas supplied to them by the Company. The amount now owing by the Municipality is about two millions of dollars; and judging from an article which appeared in the Buenos Ayres "Standard" on July 26, the treatment which has been meted out to the Company seems to be as incredible as the failure of the Municipality to pay their gas bill. It appears that the Municipal authorities sent an inspector to the gas-works, who ordered the calorimeters in use to be sent to the Direction of Public Lighting, to be compared and revised. A remarkable difference between the figures furnished by the Company and those recorded by the calorimeter in use by the Lighting Department had been previously noted; so that before the latest order was carried out, an employee of the Company proceeded to the Lighting Department and demonstrated to the Municipal officials that the department's calorimeter had been wilfully or accidentally damaged in such a manner that it registered 640 calories below the actual potency of the gas. In calling the attention of the Municipal authorities to this disclosure, the Manager of the Gas Company, according to the "Standard," adds that on examining the gas installations at the Public Lighting Department in Calle Moreno, it was found that the gas used for the testing of meters and for heating in that office was obtained by a direct connection, and without a meter. The action of the Municipality in not paying their gas bill is bad enough; but to heat their premises by a surreptitious connection with the Company's gas-mains, is a proceeding which baffles description.

High Wycombe Gas Company, Limited.—The report to be submitted at to-day's meeting of the Company states that the profit for the half year ended June 30 amounts to £1443, to which has to be added the sum of £2739 brought forward, and £136 bank interest, making a total of £4318. After paying debenture interest and preference dividend, there remains a balance of £3814, out of which the Directors recommend the payment of dividends at the rates per annum of 10 per cent. on the original shares and 7 per cent. on the additional shares. This will leave a balance of £2897 to be carried forward.

CURRENT SALES OF GAS PRODUCTS.

The London Market for Tar, Tar Products, and Sulphate.

LONDON, *Sept.* 4.

There is little new in the London tar products market. The American inquiry for creosote is rather flat in consequence of the large increased home production, and present prices offering there would not leave more than 3½d. net per gallon free alongside ship in the Thames. Makers' ideas, however, are 3⅝d. to 4d. There is a fair demand for creosote for home use as fuel, and the price obtainable is about 4d. net per gallon. Pitch is in limited demand at 20s. per ton f.o.b. makers' works for export. Crude tar is about 2½d. per gallon delivered.

Sulphate of ammonia is very firm, and large sales are reported for autumn shipment at £17 7s. 6d. net per ton, filled into buyers' bags at makers' works, for 25 per cent. quality.

Tar Products in the Provinces.

Sept. 4.

There is nothing fresh to report concerning the markets for tar products, and, on the whole, prices for the various articles remain about the same.

The average values of gas-works products during the past week were: Gas-works coal tar, 15s. 6d. to 19s. 6d. Pitch, East Coast, 16s. to 16s. 6d. per ton; West Coast, 15s. to 15s. 6d. Manchester, 16s. to 16s. 6d. Liverpool, 17s. to 18s. Clyde. Benzol, 90 per cent., North, 10½d. to 11½d.; 50 90 per cent, naked, North, 1s. 3d. to 1s. 4d. Toluol, naked, North, 2s. 3d. Coal tar crude naphtha, in bulk, North, 6½d. to 6⅝d. Solvent naphtha, naked, North, 1s. 9d. to 1s. 10d. Heavy naphtha, North, 1s. 2d. to 1s. 3d. Creosote, in bulk, North, 2d. to 2½d. Heavy oils, in bulk, 3⅛d. to 4d. Carbolic acid, 60 per cent., East and West Coasts, 3s. 4d. naked. Naphthalene salts, 75s. to 80s., bags included. Anthracene, "A" quality, 2½d. per unit; "B" quality, nominally ⅜d.

Manchester Tar Prices.

The average price realized for tar—based on the value of the products—for July deliveries in the Manchester Institution district was 20s. 8d. per ton.

Sulphate of Ammonia in the Provinces.

LIVERPOOL, *Sept.* 2.

In the early part of the week the export market remained dull, and values eased a shade more; but during the last day or two demand has improved, and some advance has taken place. The prices for prompt delivery at the close are £17 12s. 6d. per ton f.o.b. Hull, £17 17s. 6d. f.o.b. Liverpool, and £18 f.o.b. Leith. The volume of business in the forward position has continued to be restricted by the doubtful elements in the situation; but it has transpired that £18 2s. 6d. f.o.b. Liverpool has been paid for October-December shipment.

Nitrate of Soda.

The market for this material is unaltered, and spot quotations are 17s. 6d. per cwt. for ordinary quality, and 18s. for refined.

Sulphate of Ammonia.

From another source, it is stated that the prices for this article are as follows: Outside London makes, £16 15s. to £16 17s. 6d.; Hull, £17 12s. 6d.; Leith, £17 6s.; Liverpool, £17 15s.; Middlesbrough, £17 12s. 6d. to £17 15s.

COAL TRADE REPORT.

Northern Coal Trade.

The northern coal trade is slightly firmer, the demand being a little more active, and the prices on the whole rather steadier. Production is a trifle lower; and the output will be in some measure affected by the holidays in the current week. The steam coal trade shows the improvement, but there is great variation in the prices. Best Northumbrian steams are from 38s. to 45s. per ton f.o.b.; second-class steams are 31s. to 34s. per ton; and steam smalls are from 22s. to 27s. per ton f.o.b. There does not seem to be quite as much steam coal on the market as there has been of late; but the scarcity is offset by the expectation of an extension of the area of "controlled" prices to the Allies. The forward prices are obscured by the expectation. In the gas coal trade, the demand is steady, and that for home use now shows a rather more rapid growth. Prices of best Durham gas coals are generally from 34s. to 35s. per ton f.o.b.; second-class kinds are somewhere near 30s. per ton, and are in rather fuller supply; while for "Wear Specials," the current quotation is from 37s. 6d. per ton f.o.b. The increased and stiffer prices for other classes of Durham coals will steady the gas coal trade, with the fuller consumption. There is not much doing in forward contracts for gas coal, but deliveries are fairly good on the contracts running—the chief difficulty being the delay in steam tonnage. Freights are steady, especially to French ports. To the coasting ports, the current rate asked for gas coal is 12s. from the Tyne to the Thames. In the coke trade, the demand is brisk. Both for home use and for export the requirements are large—the latter especially. Good gas coke is now from 33s. to 34s. 6d. per ton f.o.b. the Tyne, with heavy freights thence to foreign ports.

Condemned Gas Mantles.—Five cases of incandescent gas mantles, imported from Rotterdam to Grimsby, and valued at £72, which were seized by the Customs on suspicion of being of enemy make, were condemned by the Stipendiary Magistrate at Grimsby. The consignee was unable, as required by the Act, to adduce proof that they were not of German manufacture.

British Goods after the War.

Mr. F. C. Tilley (of No. 53, Kingsland Road, N.E.) writes: I have noticed with much satisfaction the remarks which have been passed at some recent meetings of shareholders of large gas companies with reference to the desirability of supporting British manufacturers of mantles, glass, and other sundries which previous to the war were largely purchased from what are now known as enemy countries. A very real effort is being made by British firms, not only to meet present demands, but to retain the business after peace is declared; and these efforts will be much encouraged and assisted by its being known that large users are prepared to support them. Many difficulties with regard to the supply of raw material and labour have had to be faced; but once these difficulties are overcome, it is confidentially expected that home traders will be fully able to supply the present needs, and, in addition, be prepared for the increased requirements which will follow the declaration of peace. When this comes, no doubt, some sacrifices for a time will be necessary on the part of buyers, in order to overcome the temptation to purchase supplies from foreign sources at lower prices. I hope the patriotism of the country which has been shown during the war will continue, so as to enable those who have done their best to meet a difficult case, to retain the business in more profitable and less trying circumstances. Many of our sons, brothers, and nephews will have given their lives in order to defeat those whose commercial efforts (among their other wrong-doings) have not been in agreement with our ideas as to what is right; and we are called upon to continue their work, by seeing that nothing having the slightest taint of Germany's or its Allies' production is imported into the Empire.

Price of Gas at Kilsyth.—The Kilsyth Town Council have decided to further increase the price of gas. This will be the second advance since the war began. The new charges are 3s. 4½d. per 1000 cubic feet for ordinary meters, 3s. 7d. for prepayment consumers, and 3s. 1½d. for power purposes.

Increased Profits at Northwich.—At the half-yearly meeting of the Northwich Gas Company, presided over by Mr. C. T. Eachus, the statement of accounts for the six months ended June 30 showed that there had been an increased profit of £255 over last year's figures. The gas-rental had been increased by £606, due partly to the higher prices charged, while the cost of coal had increased by £715. The quantity of coal carbonized had decreased by 10 per cent. The gas made decreased by 8¼ per cent.; while the quantity sold was 1¾ per cent. below last year's figures. The Chairman complimented the management on the excellent results, and said the accounts were particularly gratifying when the high cost of coal and other materials was considered. Interim dividends were declared of 4 per cent. on the preference shares, free of tax, and 4 per cent. on the ordinary stock, less tax—equivalent to 6⅔ per cent. on the old ordinary shares.

Engagement of Labour.—Great antagonism has been aroused throughout the North of England by a proposal which has been extensively promulgated by highly-placed Labour Exchange officials that after the war the whole system of the engagement of labour for any purpose should be in their hands. Startling as it may appear, the proposal is that it should be made a penal offence for any person to offer service to an employer or any employer to take a person into service except through the Labour Exchanges. The "Yorkshire Post" has prominently sounded the note of alarm, and has consulted the views of the chief employers and trade union leaders in the great industries in regard to the matter, with the result of accumulating a striking mass of condemnation of the proposal from both employers and employed. It is believed in the North that the proposal has its origin in socialistic circles in London, where it has been determined to take permanent advantage for socialistic ends of the disturbance of normal employment conditions caused by the war.

Reduced Output at Newark.—At the annual meeting of the Newark Gas Company, held last Thursday, Mr. T. Bradley, J.P., the Chairman, expressed gratification that the undertaking had been thoroughly well supported by the staff in the present strenuous times; but the men at the works had not met the Directors as might have been expected. There had been a reduction in the amount of gas manufactured. The report disclosed a diminution of 8,000,000 cubic feet on the year; the darkened streets and lower private consumption accounting for this. For public lighting, only £33 had been received in the past twelve months, compared with £500 to £600 in previous periods. Although the price of gas to consumers was now 2s. 11d. per 1000 cubic feet—and he should very much like to see it stop there—he was uncertain, even with the most economical management, whether this figure could be retained. They had been pressed by the Government authorities to supply toluol, which involved an expense to the Company. Dividends were declared of 10 per cent. on the "A" shares, 5 per cent. on the "B" shares, and 7 per cent. on the new ordinary shares.

Gas and Electricity at Bognor.—It was stated in the report adopted at the meeting of the Bognor Gas Company that the accounts for the six months ended June 30 showed a balance of £3413 at the credit of net revenue account. From this sum, the Directors recommended a declaration of a dividend for the half year at the rate of 3 per cent. per annum upon the whole of the stocks, less income-tax. The dividend would amount to £1164, leaving a balance of £2249 to the credit of the profit and loss account. The continued high price of coals, &c., having affected the amount of profits, the Directors considered it prudent to recommend the above rate of dividend for the half year, in view of the apparent enhanced prices of manufacturing materials and the further reduced consumption of both gas and electricity occasioned by the Summer Time Act. Arising from the increased cost of fuel, oil, &c., the Directors decided to raise the price of electric current from June 30. The Chairman (Mr. H. Lovett, J.P.), said if this dividend and that for the previous half year were put together, it would be seen that the amount was within ¾ per cent. of what they were allowed to pay on the price charged for gas. The Directors had followed their policy of putting by for a rainy day; and he thought this would be endorsed by the shareholders.

Batley Municipal Undertakings.

The Borough Treasurer of Batley (Mr. R. G. Rutter) has issued his annual abstract of the Corporation accounts, dealing with the financial year to March last. From this it appears that the gas-works yielded a net profit of £1843; and he says that an unsatisfactory feature of the finances of the department is that at the beginning of the year the Corporation appropriated £2550 for the relief of rates, or £706 more than the profit that was eventually realized. Thus there was a deficiency of £459, after using a surplus of £247 with which the year began. There is a contingency fund of only £1820, although the capital outlay on the undertaking has been £195,235. As a concern to yield profits for the relief of the rates, the department is on the down-grade; the amounts transferred from it for this purpose in the last five years being £4650, £6025, £4750, £4650, and £2550. The electricity works produced a net profit of £298, from which £125 was taken for a special sinking fund, and a surplus of £57 at the beginning of the year was increased to £231. The water-works fund accounts show a gross profit of £14,975, out of which there were interest and sinking fund payments of £14,058, leaving a net profit of £917, which wiped-out a deficit of £520; and there remained a surplus of over £396. This profit may be considered satisfactory, having regard to the fact that in 1913-14 and 1914-15 there were losses, the respective amounts of which were £530 and £206.

Gas-Workers' Wages at Dundee.—An application signed by 83 men employed in the Dundee Corporation Gas Department for an increase of 1d. per hour in their wages was considered at a meeting of the Gas Committee last Thursday. The Engineer (Mr. A. Yuill) said the wages now paid were very much on the same scale as those at Edinburgh and Glasgow, and higher than were paid at Aberdeen. He suggested that the matter should be submitted to arbitration, and this the Committee agreed to.

Patriotism at Watford.—The half-yearly meeting of the Watford Gas Company was presided over by the Chairman (Mr. E. J. Slinn), who said there had been a most gratifying spirit of patriotism among the employees, who had joined the Colours in large numbers, notwithstanding the fact that they were engaged in a certified occupation. Of the men on the regular staff, 56 had joined, and eight of those employed occasionally. Several of the office staff had also left for military service. Allowances for those on active service for the year ended June 30 amounted to £278, war bonuses to £363, and pensions to old employees to £101, making in all £742. Associated with the Company were 120 co-partners, holding £3700 of the Company's stock, as a result of the savings of the past six years. The stock of coal and oil with which they started the half year was an excellent one, and the contractors were supplying them very well. The Board hoped in a short time to be able to announce a reduction in the price of gas. The revenue account showed a profit of £5863, and the profit and loss account a balance of £8356 available for dividends, which were declared at the full statutory rates.

High Cost of Coal at Sutton.

Attention was drawn by the Chairman (Mr. Thomas Charles), when moving the adoption of the report at the half-yearly meeting of the Sutton Gas Company, to the burden placed upon the Company, by the heavy increase in the cost of coal. In 1912, he said, they were paying 15s. 2d. a ton, in 1913 the cost was 20s. 6d., in 1914 it was 21s. 11d., in 1915 it rose to 25s. 1d., while in 1916 it was 32s. 11d. A comparison between the years 1912 and 1916 would show this increase actually involved an increased payment of £9900, equivalent to 17s. 9d. a ton more, and actually equal to 1s. 7d. in cost per 1000 cubic feet of gas. In 1912 the Company were selling gas in Sutton at 2s. 6d.; and to-day the price was 3s. If they made a comparison between last year and this, they would see they were paying for coal £4258 more than they were paying last year. That was to say, they were actually paying for the half-year more for coal than was required for the payment of a six months' dividend. He thought they would consider that, when under these circumstances gas was being sold locally at 3s. per 1000 cubic feet, the shareholders had made a very heavy concession indeed to their partners, the consumers, and that the dividend of 5¼ per cent. now recommended was, in the circumstances, a very reasonable one. They were paying by way of war bonus, &c., a sum equivalent to 1½d. per 1000 cubic feet, which was an additional difficulty that had to be met. The report was adopted.

Cheshunt and an Increase in the Price of Gas.—At a special meeting of the Cheshunt District Council, held to consider a proposal by the Gas Company to increase the price of gas from 3s. 2d. to 3s. 10d. per 1000 cubic feet, Mr. Castello said the Council were only doing their duty if they protested in the strongest possible manner against the rise. There did not seem to be any possible reason for such an increase as 8d. per 1000 cubic feet, especially for the quality of gas they were getting. His opinion was that they should call a town's meeting; and he suggested that people should go back to the use of oil. It was decided to summon a town's meeting to protest against the proposed increase.

New Lighting Order for London.—A new lighting order came into force in London last Friday, under which all external lights, whether public or private, must be extinguished, with the exception of such public lamps as the Commissioner directs to be kept in use for public safety. All lights not extinguished must be reduced to a minimum intensity, and so obscured that no more than a diffused light is cast on the ground. Internal lighting must be so reduced or shaded that no more than a dull, subdued light is visible from any direction outside, and no part of the pavement or roadway or any building or object is illuminated. The order will apply to the City of London and the whole of the Metropolitan Police district, from 8 p.m. until one hour before sunrise from Sept. 1 to 15, from 7.30 p.m. from Sept. 16 to 30, from 6 p.m. from Oct. 1 to 15, from 5 30 p.m. from Oct. 16 to 31, and from 5 p.m. from Nov. 1 until the issue of a further order.

A MEMO FROM MAINS.

You will need *still* more D.S.O.
and St. Nicholas Fires this season.
Notwithstanding "War pressure"
we shall be ready for your orders.
Let us know your needs *early*.

R. & A. MAIN, LIMITED.

WORKS: Gothic Works, EDMONTON, N.; Gothic Ironworks, FALKIRK; and Gothic Works, BIRMINGHAM.
SHOW-ROOMS AND BRANCHES: 25, Princes Street, Oxford Circus, W.; 136, Renfield Street, GLASGOW; 83, Old Market Street, BRISTOL; 18, Severn Street, Deansgate, MANCHESTER; 97, Millfield, BELFAST; 333, Queen Street, MELBOURNE; and 12, Cunningham Lane, Pitt Street, SYDNEY, N.S.W.

Zeppelin Bombs on a Gas-Works.

Dealing with last Saturday night's Zeppelin raid by thirteen enemy airships, a correspondent of "The Times," under the heading of "Little Damage in the Country," says: Soon after midnight, three bombs were dropped on a village; and a few minutes later a Zeppelin was seen approaching a small town. Bombs began to drop almost immediately; and altogether eighteen or nineteen fell in the district. The Zeppelin could be seen flying at a great height. Some were incendiary bombs, and others explosive. The chief damage was done to the local gas-works. A shrapnel shell fell on to a gasholder, puncturing it, and allowing the gas to escape. Immediately afterwards, an incendiary bomb set the gas alight. There was a tremendous sheet of flame, which lit up the whole of the town, and caused two adjoining gasholders to catch fire. The fire from the three gasholders was visible 20 miles away. The gas-works manager had an extraordinary escape; his house, which adjoins the works, being partially wrecked by the explosion. Not one of the occupants of the house was injured. The fire brigade turned out, and quickly extinguished the fires at the gas-works.

Gas Company's Clerk and Exemption.—The Bexhill Gas and Water Company applied to the local Tribunal for unconditional exemption of their chief clerk (aged 27), who, it was said, was "indispensable and irreplaceable." He had been with the Company for eight years, and had technical knowledge of the working. The whole revenue passed through his hands. All the other clerks who were in the Company's employ before the war had joined up, and they had been replaced by ineligible men. But owing to the new Act, these men were liable to re examination. In fact, one of their men at the present time had been passed for garrison duty abroad, and would leave at the end of September. The Tribunal granted one month (final).

Aberystwyth Gas Company's War Profit.—In submitting to the proprietors the accounts for the first half of this year (revealing a balance of profit of £1056), the Directors of the Company say that, under pressure of increased cost of labour, coal, and other things, they were from Jan. 1 compelled to raise the price of gas. But in so doing they had exercised the strictest regard for the consumers, and limited the advance to 3d. per 1000 cubic feet. A sum of £365 has been paid to the Government for war profit for the six months ended June 30, 1915. The conditions, however, that enabled the Company to realize the profit upon which this charge has been levied were but short-lived, and have given place to others of an adverse nature. There are now no soldiers in the town, not a public lamp is in use, and a disposition to economize is apparent in all directions. In these circumstances, there is room for congratulation that the present outlook is so favourable. The increased charge for gas entails a diminution of dividend of 5s. per annum for each penny on the original shares, and 3s. 6d. on the new shares. The interim dividends will consequently be at the rates of 12¾ per cent. on the original shares and £8 18s. 6d. per cent. per annum on the new shares, less income-tax.

A Smaller Consumption at Eastbourne.

At the opening of the proceedings at the meeting of the Eastbourne Gas Company, sympathetic reference was made by the Chairman (Alderman J. C. Towner) to the late Mr. John Hammond, whose death was recorded in last week's issue of the "JOURNAL." They could, he remarked, safely say that the progress of the Company had been good, and a great deal of the success attained was due to Mr. Hammond's excellent management. They all knew his good qualities, and missed him very much. A vote of condolence was passed with the widow and family. The revenue account for the six months ended June 30 showed a profit of £6358; and there was a balance of £8730 at credit of profit and loss account. The Directors therefore recommended a dividend for the past half year at the rates of 7⅛ per cent. per annum on the "A" stock, 5⅝ per annum on the "B" stock, and 5 per cent. on the preference stock, absorbing £7963, and leaving a balance of £767 to be carried forward. The report pointed out that, arising from the higher cost of coal and oil, it was decided to increase the price of gas by 2d. per 1000 cubic feet at the end of the March quarter. The contracts since entered into constitute a still greater increase in the cost of gas-making materials; and a further increase in the charge for gas is therefore unavoidable. A statement presented by the Secretary (Mr. J. S. Garrard) showed that there had been a reduction of £1426 in the net profit of the half year. The cost of coal had increased from 26s. 6d. per ton last year to 30s. 3½d. this. Despite the restrictions and the entire loss of street lighting, the consumption of gas had receded only 7 07 per cent. The number of consumers had, however, grown; and in all ways there was evidence of a healthy expansion of inquiries and business such as would, in normal times, mean a growing revenue. A big stock of coal had been built-up; but it had had to be done almost regardless of cost. It was mentioned that nearly a hundred of the employees are now shareholders in the Company. Mr. H. E. Jones, proposing a vote of thanks to the Directors, officers, and workmen, said he had worked with the late Mr. John Hammond throughout the whole 27 years of his connection with the Company. Mr. Hammond was always, so to speak, "on the job," and to the end fully determined to do his best in what he had to do.

Clonmel and the Coal Question.—At a recent meeting of the Clonmel Union, there was read a resolution from the Irish Association of Gas Managers [*ante*, p. 344] protesting against the present methods regarding the coal supply, and stating that small gas-works and industries in the country would have to close-down if an adequate supply at reasonable prices was not received. Mr. Lyons said that many gas-works were owned by monopolists; and by adopting the resolution, they might be helping them. The Chairman, however, pointed out that the resolution concerned the whole country. The Clerk said he would like to make an addition to the resolution, that the Union were of opinion that it should apply to the general supply. This was agreed to, and the resolution carried.

"Burn-All"

Printed particulars concerning this new Davis development will shortly be available, and should be applied for without delay.

THE DAVIS GAS STOVE Co. Ltd

THE GAS EXHIBITION SALONS,
60, OXFORD STREET, LONDON, W.

Metropolitan of Melbourne Gas Company.

Yesterday's mail from Australia brought a copy of the balance-sheet of the Metropolitan Gas Company (of Melbourne), presented at the seventy-seventh ordinary general meeting of the shareholders, held on Friday, July 28. The Directors reported the profit for the six months to June 30 as being £97,280, out of which they had transferred to the reserve fund £27,000, to the meter renewal fund £5000, and to the gas-stoves account £3000. They recommended a dividend of 6s. 6d. per share, amounting to £62,219. These payments would absorb the whole of the half-year's profits except £61, which would increase the amount carried forward from the previous balance-sheet to £54,156. The gas made in the six months was 1793 millions; and that sold was 1550 millions. There were 6694 public lamps supplied. The coals carbonized during the half year amounted to 128,189 tons, and the residuals made were: Coke, 87,253 tons; tar, 1,502,405 gallons; and sulphate of ammonia, 1356 tons.

Winchester Water and Gas Company.—At the half-yearly meeting of the Company on Monday of last week, it was reported that the balance of net revenue account available for dividend was £9123. The Directors recommended the payment of a dividend on the preference stock at the rate of 4 per cent. per annum, and on the consolidated ordinary stock at the rate of 4¼ per cent. per annum, for the half year. The Company, in common with others, it was stated, are experiencing difficulty in obtaining deliveries of coal bought under contract. But the Directors are satisfied that the contractors are doing their utmost to fulfil their obligation; and it is expected that an adequate supply will be received. The labour difficulty, too, is increasing, and is serious; and the Directors have therefore decided to instal machinery in the retort-house. There has been a decreased consumption of gas; but there has been a considerable increase in the consumption of water. The report was adopted.

Worthing Gas Company.—At the half-yearly meeting of the Company on Saturday, the Chairman (Mr. H. H. Gardner) drew attention to the fact that during the period under review the capital account was added to by a sum of £4700, and was consequently largely overexpended; but fortunately they had had sufficient funds in hand to defer the necessity of issuing further stock. Sales of gas showed an increase of £110, and residuals of £1105. The cost of coals was more by £927. The balance carried to the profit and loss account was £3581, as compared with £4383, or a decrease of £802; but they always regarded the first half year as the leaner one, and as far as he could see they did not anticipate any further rise in the price of gas. A dividend at the rate of 5 per cent. per annum was declared. In replying to a vote of thanks to the staff, the Engineer and Manager (Mr. S. O. Stephenson) commented on the small increase in the price of gas. They had had to increase it by 3d. per 1000 cubic feet as from the March quarter in 1915; but this was only 2d. over what it was when he came there just prior to the war.

APPLICATIONS FOR PATENTS.

[Extracted from the "Official Journal" for Aug. 30.]

Nos. 11,813—12,122.

ACETYLENE ILLUMINATING COMPANY.—"Storing gases under pressure." No. 11,868.

AJAX HEATERS LIMITED.—"Apparatus for heating water." No. 11,969.

BARK, W. T.—"Effecting removal of carbon deposit from retorts." No. 11,830.

BARNBY, F. M.—"Reflex valves." No. 11,917.

BUSSELL, R. C.—See Ajax Heaters. No. 11,969.

CHAMBERS, E. V.—"Obtaining sulphite of ammonia from coal gas." No. 11,937.

DAVIS, G. K.—"Gas-washers, &c." No. 11,964.

DAVIS, R. H.—"Hermetically closed lamps." No. 11,911.

DENTON, J. J.—"Producing and controlling high temperatures in furnaces." No. 11,844.

FORWOOD, G. F.—"Treatment of hydrocarbons." No. 12,027.

HAMMOND, T. C.—See Chambers. No. 11,937.

HELPS, G.—"Utilization and combustion of fuel." No. 12,011.

KEITH, J. & G.—"Art of lining crucible furnaces." No. 11,853.

MAIN, A. P. & R. B.—"Gas heating stoves." No. 11,924.

MARVIN, C. J.—"Generating gas." No. 11,973.

PIGGOTT AND CO., T.—See Barnby. No. 11,917.

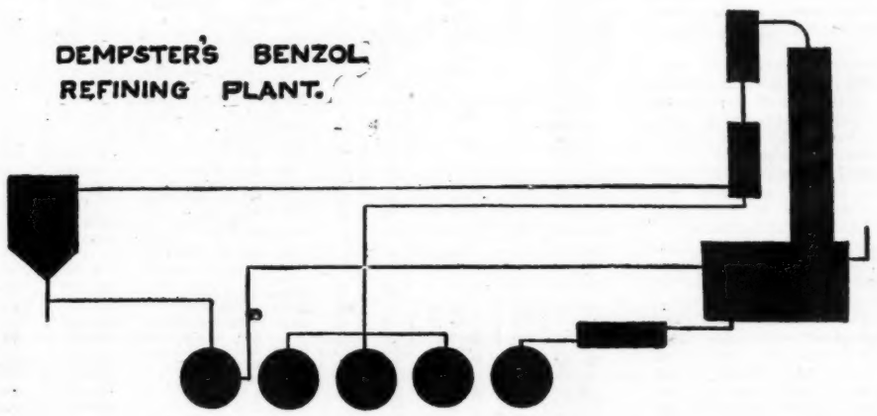
RICHARDSON, C. K.—See Chambers. No. 11,937.

WHIBLEY, R. J. M.—See Acetylene Illuminating Company. No. 11,868.

WILSON, G. & J. H.—"Coin-operated gas-meters." No. 11,845.

Wolverhampton Gas Company.—In moving the adoption of the report at last week's meeting of the Wolverhampton Gas Company, the Chairman (Mr. B. O. Clark) remarked that, notwithstanding the war, they were going on very well, and it was hoped that matters would continue as satisfactorily. They had, however, been hampered on the score of labour, no fewer than 72 men having joined up. Dividends were declared, less income-tax, at the rates of 3 per cent. on the preference stock, 5 per cent. on the consolidated stock, and 3 per cent. on the new ordinary stock.

Non-Payment of a Public Lighting Account.—The "Electrical Review" reports that at a meeting of the Rosario Municipal Council, the action of the Intendent in ordering the substitution of electric lighting for gas lighting, in view of the Gas Company's suspension of the service, was approved. Also an expenditure of $25,000 m/n. on the necessary electrical material in Buenos Ayres was authorized. The Gas Company were obliged to suspend the service owing to being unable to purchase coal, due to the Rosario Municipality not having paid the gas bill of about $350,000 m/n.



DEMPSTER'S BENZOL REFINING STILLS

AT THE PRESENT TIME ARE PRODUCING

100,000 GALLONS

OF REFINED PRODUCTS PER DAY.

R. & J. DEMPSTER, LTD. MANCHESTER.

Power Gas Price at Waterford.—The Waterford Gas Company have reduced the price of gas for power from 4s. 9d. to 4s. 2d. per 1000 cubic feet. From July 1 they had charged 4s. 9d. for both lighting and power.

Blackburn Gas-Works Improvements.—An application by the Blackburn Corporation for sanction to borrow £74,568 for the extension and improvement of the Greenbank Gas-Works [in accordance with the report and recommendations of Mr. A. Morton Fyffe, the Engineer and General Manager, as published in the "JOURNAL" for July 25, p. 177] was the subject of an inquiry last Friday by Mr. A. G. Drury, on behalf of the Local Government Board. The Town Clerk (Mr. Lewis Beard) explained the scheme, to which there was no opposition; and detailed evidence was given by Mr. Fyffe. It was explained that the application was not really for a loan, but for permission to exercise existing borrowing powers. The work includes the provision of a 3 million cubic feet per day vertical retort installation; and the Town Clerk said it would result in sixty men being liberated for military service or munition work. If the scheme was not sanctioned, the alternative would be a temporary arrangement which would cost thousands of pounds, and would only be of a makeshift character. As it was, they would have to scrape through this winter as best they could.

Bodmin Gas Company.—Presiding at the annual meeting of the Bodmin Gas Company, Mr. H. D. Foster congratulated the shareholders on the satisfactory position of the undertaking, and said he believed they were the only Company in Cornwall who had not increased the price of gas. There was a decrease of 1,000,000 cubic feet in the sales of gas, owing to the reduced lighting and the operation of the Summer Time Act. As the price of coal increased, they might have to raise the price of gas; but it was not necessary to do so at present. The net profit was £877, the lowest since 1903. Dividends were declared of 9s. 2d. on the "A" shares and 2s. on the "B" shares.

Smaller Consumption at Chichester.—The effect of the restriction of lighting regulations was, the Directors of the Chichester Gas Company remarked in submitting the accounts for the past half year, shown by a reduction in the quantity of gas sold of about 11 per cent. This, with £320 extra paid for coal, materially affected the accounts. The balance standing to the credit of the profit and loss account amounted to £1422, out of which the Directors recommended the declaration of a dividend for the six months at the rate of 5 per cent. per annum upon the "A" stock and 3½ per cent. per annum on the "B" and "C" stocks, all less income-tax. The payment of these would absorb the sum of £783.

STOCK MARKET REPORT.

THERE was nothing much to complain of in the condition of markets in general on the Stock Exchange last week beyond their pronounced quietude, and that, of course, was a foregone conclusion at this season of the year. The satisfactory feature was that they gave no sign of weakness. On the contrary, the slackness and paucity of business was itself to a great extent an effect of their strength; for holders clung firmly to their stocks despite the temptation of higher prices. This was not to be wondered at; for all factors of influence were highly favourable—the now regularly recurrent cheering despatches from each of our many battlefields being last week capped by the entry of Roumania upon the scene.

Home Government issues responded brightly to the general demand, and the War Loan and Consols advanced. Home Rails were in excellent request, and seemed more calmly to regard the chances of labour troubles. But this anxiety was more keenly experienced by American lines, and the prospect of maintaining appears to be precarious. Canadian traffics should have warranted a larger advance but for uneasiness in regard to crops. Argentines got better as the week went on. The Foreign Market did not present its usual string of good things. But Japanese was strong; and Brazilians and Roumanian were wanted. South African things were firm.

In the Miscellaneous Markets, oils were prominently strong, and rubber fairly so, though irregular at times. Munitions of war continued in great request; and in Banks (which were firm) the invasion of Ireland by the City and Midland attracted considerable notice.

Business in the Gas Market was on the usual modest scale. The general tendency was quite firm; and again last week, as in the week before, the Metropolitan and Suburban Companies showed higher figures. Imperial Continental was prejudicially affected by the report from Amsterdam that the Berlin undertaking of the Association is to be compulsorily liquidated by the German Government as a reprisal for English liquidations of alien enemy concerns. The price fell sharply thereupon, but steadied later. Further attention was drawn in the Daily Press to claims by the Primitiva Company against the Municipality of Buenos Ayres. Possibly Government action will be taken.

In the Money Market, the position was quite easy at the close. An improvement in the Russian Exchange followed upon the entry of Roumania into the world-fray. The Chancellor of the Exchequer now has £908,000,000 of Treasury Bills outstanding.

Bargains done for cash during the week were as follows: On Monday, European 12⅜, Gas Light ordinary, 79⅝, 80, ditto preference 74¼, 74½, Oriental 108½, 109, Tottenham "B" 90¾. On Tuesday, Brentford "B" 84, Commercial debenture, 56¾, Gas Light ordinary 79½, 79¾, 80, 80½, Imperial Continental 85½, Primitiva 41s. 6d., ditto preference 71s. 3d., 72s. 6d. On Wednesday, Commercial 4 per cent. 76, Gas Light ordinary 79¾, 79⅞, 80, 80¼, ditto debenture 63½, South Metropolitan 85. On Thursday, European 13¼, 13 11/16, 13⅜, Gas Light ordinary, 79½, 80, ditto maximum, 60½, ditto preference 74¾, ditto 10 per cent. bonds 182¾, 183½, Imperial Continental 90. On Friday, Gas Light ordinary 80⅛, Imperial Continental 87, 87½, 88, 89, 90, Primitiva preference 71s. 3d., 72s. 6d., 73s. 9d.

The Bank rate is 6 per cent.,—as fixed on July 13.

ANTE-WAR PRICES AND DIVIDENDS, LATEST DIVIDENDS, AND LAST WEEK'S BARGAINS.

Issue.	Shares.	When ex-Dividend.	Previous Div. or Dividend & Bonus.	Last Dividend.	NAME.	Closing Prices, July 30, 1914.	Present Prices.	Lowest and Highest Prices of Bargains.
£			p.c.					
175,472	Stk.	Mar. 10	4	4	Aldershot 4 p.c. Pref. .	..	65—70	..
1,651,868	,,	April 8	2½	5⅛	Alliance & Dublin Ord.	59—64	64—66	..
374,000	,,	July 10	4	4	Do. 4 p.c. Deb.	76—79	64—65	..
280,000	5	April 29	7½	3/-	Bombay, Ltd. . . .	5¼—6¾	5—5½	..
50,030	10	Feb. 26	16	15/-	Bournemouth Gas and Water { 10 p.c. . .	29—30	25—27*	..
333,110	10	,,	7	7/-	{ B 7 p.c. .	15—15½	11—11½*	..
115,000	10	,,	6	6/-	{ Pref. 6 p.c.	13½—14	9½—10½*	..
153,740	—	—	—	4	{ 4 p.c. Deb.	..	73—75	..
992,045	Stk.	Feb. 26	†14	66/-	Brentford A Consold. .	261—266	86—88	..
734,900	,,	,,	†11	55/-	Do. B New . .	204—209	83—85	84
55,000	,,	,,	5	5	Do. 5 p.c. Pref. .	109—111	85—90	..
221,400	,,	June 11	4	4	Do. 4 p.c. Deb. .	91—93	..	..
217,380	Stk.	Feb. 26	11	10⅜	Brighton & Hove Orig.	208—213	172—173	..
244,200	,,	,,	8	7¾	Do. A Ord. Stk. .	154—159	125—127	..
580,000	20	Mar. 26	12½	22,6	British	44—45	34½—35½	..
120,000	Stk.	June 26	4	4	Do. 4 p.c. Deb. Stk.	88—90	71—73	..
245,771	Stk.	June 26	4	4	Buenos Ayres 4 p.c. Deb.	85—87	60—65	..
100,000	10	—	—	—	Cape Town & Dis., Ltd.	1½—2½	1½—1⅝	..
100,000	10	—	—	4/6	Do. 4½ p.c. Pref. .	4—6	4⅜—5	..
100,000	Stk.	June 26	4½	4½	Do. 4½ p.c. Deb. Stk.	70—76	60—65	..
157,150	Stk.	Feb. 26	5	5	Chester 5 p.c. Ord. . .	108—110	87½—88½	..
1,513,280	Stk.	Feb. 12	5 9/4	49/4	Commercial 4 p.c. Stk.	106—108	73—74*	76
560,000	,,	,,	5¼	46/8	Do. 3½ p.c. do. .	103—105	68—70*	..
475,000	,,	June 11	3	3	Do. 3 p.c. Deb. Stk.	69½—71½	55—57	55¼
800 000	Stk	,,	4	—	Continental Union, Ltd.	76—79	36—38	..
200 000	,,	,,	7	—	Do. 7 p.c. Pref.	115—118	55—57	..
278,450	—	—	—	11½	Croydon B and C 7 p.c.	..	175—185*	..
—	—	—	—	—	Do. E	..	..	..
492,370	Stk.	—	6	5¾	Derby Con. Stk. . . .	128—135	..	..
55,000	,,	—	4	4	Do. Deb. Stk. .	102—104	..	..
1,002,180	10	July 29	10	10/-	European, Ltd. . . .	17½—18	12½—13½	12⅝—13⅜
16,318,430	Stk.	Feb. 10	1/17/4	42/-	Gas { 4 p.c. Ord. . .	98—102	79½—8 ½	79½—8½
2,600,000	,,	,,	3½	3½	Light { 4½ p.c. max. .	76—79	5½—61	60½
4,062,235	,,	,,	4	4	and { 4 p.c. Con. Pref.	96—99	73—75	74½—74⅞
4,674,850	,,	June 11	3	3	Coke { 3 p.c. Con. Deb.	72½—74½	59—61	61½
130,000	,,	,,	10	10	{ 10 p.c. Bonds .	..	..	182¾—183½
258,740	Stk.	Mar. 12	5	4½	Hastings & St. L. 3½ p.c.	87—89	80—85	..
70,000	10	April 29	11	6	Hongkong & China, Ltd.	16½—16¾	8—9	..
86,500	—	—	—	9½	Hornsey 7 p.c. . . .	..	125—135*	..
181,000	Stk.	Mar. 12	7½	7½	Ilford A and C . . .	151—154	115—120	..
65,780	,,	,,	6⅝	5⅝	Do. B	115—118	105—110	..
65,500	,,	June 26	4	4	Do. 4 p.c. Deb. . .	92—94	73—76	..
4,940,000	Stk.	May 14	9	4½	Imperial Continental .	150—160	87—92	85½—90
1,336,000	Stk.	Feb. 12	3½	3½	Do. 3½ p.c. Deb. Red.	84—86	65—67*	..
235,342	Stk.	Mar. 12	6½	6½	Lea Bridge Ord. 5 p.c. .	119—121	87—92*	..
2,498,905	Stk.	Feb. 26	10	5	Liverpool 5 p.c. Ord. { A	211—213	87—83*	..
					{ B	146—148		
306,083	,,	June 26	4	4	Do. 4 p.c. Pr. Deb. Stk.	..	78½—79½	..
75,000	5	June 11	6	2/-	Malta & Mediterranean	4½—4¾	4—4¼	..
250,000	100	April 1	4½	4½	Met. of Melbourne { 4½ p.c. Deb.	99—101	90—98	..
541,920	20	May 28	4	6/-	Monte Video, Ltd. . .	11½—12	8½—9½	..
1,375,892	Stk.	July 29	4½	4½	Newc'tle&G'tesh'd Con.	93½—99½	79½—80½	..
532,705	Stk.	June 26	3½	3½	Do. 3½ p.c. Deb.	82—83	75—77	..
55,940	10	Feb. 26	7/14/0	7/8/2	North Middlesex 7 p.c.	14—15	11—12	..
800,000	Stk.	May 14	8	8	Oriental, Ltd. . . .	117—122	108—110	108¾—109
60,000	5	Mar. 26	10	1/-	Ottoman, Ltd. . . .	7½—7¾	2—3	..
60,000	50	Feb. 26	13	65/-	Portsea, Island B . .	128—131	92—97*	..
100,000	50	,,	12	60/-	Do. C . .	118—121	92—97*	..
52,000	50	,,	10	—	Do. D . .	..	..	..
249,980	5	April 29	8	—	Primitiva Ord. . . .	5½—6	2—2½	4 1/6
499,960	5	June 26	5	2/6	,, 5 p.c. Pref. .	4½—5	3⅝—3⅞	71/3—73/9
521,600	100	June 2	4	4	,, 4 p.c. Deb. .	91—93	80—82	..
—	—	—	—	4	,, ,, ,, 1911	..	..	..
846,198	Stk.	June 26	4	4	River Plate 4 p.c. Deb.	85—87	60—65	..
150,000	10	May 14	6	6/-	San Paulo { 6 p.c. Pref.	10½—11	8¼—8⅝	..
125,000	50	July 1	5	5	{ 5 p.c. Deb.	47—49	43—45	..
135,000	Stk.	Mar. 12	10	10	Sheffield A	223—224	186—190	..
209,984	,,	,,	10	10	Do. B	222—224	186—190	..
528,500	,,	,,	10	10	Do. C	220—222	186—190	..
90,000	10	May 28	9	6-	South African . . .	10½—11½	..	..
6,609,895	Stk.	Feb. 10	5/4/0	44/-	South Met., 4 p.c. Ord.	111—113	83—85	85
1,895,445	,,	July 10	3	3	Do. 3 p.c. Deb.	73½—74½	59—61	..
224,820	Stk.	Feb. 26	8½	8	South Shields Con. Stk.	157—159	152—154	..
952,795	Stk.	Feb. 26	6	48/4	S'th Suburb'n Ord. 5 p.c.	114—116	80—82	..
60,000	,,	,,	5	5	Do. 5 p.c. Pref. .	110—112	79—81	..
135,000	—	—	—	48/4	Do. West Kent. .	..	..	..
187,558	,,	June 26	5	5	Do. 5 p.c. Deb. Stk.	116—118	90—92	..
647,740	Stk.	May 14	5	5	Southampton Ord. . .	99—102	90—95	..
120,000	Stk.	Feb. 12	7½	7½	Tottenham { A 5 p.c. .	136—138	120—123	..
782,275	,,	,,	6	6	{ B 3½ p.c. .	115—117	90—92	90¾
181,255	,,	June 26	4	4	District { 4 p.c. Deb.	87—89	73—75	..
182,380	10	Dec. 30	5	—	Tuscan, Ltd.	5—6	1—2	..
149,900	10	July 1	5	5	Do. 5 p.c. Deb. Red.	93—95	60—65	..
286,476	Stk.	Mar. 12	5	5	Tynemouth, 5 p.c. max.	103½—109½	93½—94½	..
					Wandsworth, Wimbledon, and Epsom—			
30,000	Stk.	Feb. 26	8⅝	78/9	Wandsworth A 5 p.c.	151—156	117—122	..
255,636	,,	,,	6⅝	63/9	,, B 3½ p.c.	129—134	101—102	..
108,075	,,	,,	5/17/8	55/1½	,, C 3½ p.c.	110—115	88—93	..
852,000	,,	,,	6½	57/6	Wimbledon 5 p.c. .	117—122	91—93	..
98,000	,,	,,	6⅝	63/9	Epsom 5 p.c. . . .	121—126	98—103	..
88,416	..	June 26	8	8	3 p.c. Deb. Stk. .	66—69	53—56	..

* Ex. Div. † Paid on Old 10 p.c. and 7 p.c. Standard Stocks.

Increase in Price at Chorley.—The Chorley Town Council have decided to increase the price of gas (from Oct. 1) 6d. per 1000 feet to ordinary consumers, and to reduce the quantity supplied for a penny through prepayment meters. Mr. E. W. Heald (the Chairman of the Gas Committee), said the increase was due to the advance of raw material. It was estimated that in 1917 they would have to pay £4366 more for coal than in 1916. In ten years the price had increased by 125 per cent. As a result of the absence of street lighting and the effect of the Daylight Saving Act there had been a decreased make of gas since April, of 9,302,000 cubic feet. They would also have £700 more to pay in sinking fund and interest.

Cork Gas Undertaking.—The ordinary general meeting of the Cork Gas Company was presided over by Mr. W. B. Harrington, who expressed regret that expenses under almost every heading had increased, with the result that the profit, after allowing a small sum for depreciation, amounted only to £1774, and this notwithstanding the advance in the price of gas. The present price of Newcastle gas coal was about double what it used to be; while freightage was five times as much. Putting out of consideration altogether the present high price of coal, the freight alone from the East Coast cost them now about one-and-a-half times as much as freight and coal combined did in ordinary times. The Directors proposed to pay a dividend at the rate of 5 per cent. per annum, though they had not earned the money. It would be necessary to supplement the profit by taking £1150 from the reserve fund. The consumption of gas for lighting purposes showed some decrease, caused by the operation of the Summer Time Act; but, on the other hand, the consumption for stoves and general heating showed a substantial increase. The report was adopted. Mr. Rowe said it was a long time since they had had such a small dividend; but they quite recognized the position.

Position Maintained at Barnsley.—Mr. E. G. Lancaster informed the proprietors of the Barnsley Gas Company, when addressing them at the annual meeting, that they had come through an anxious year better than was at one time expected. Everything had seemed to go against them. The war had taken their best men away, and coal had been dearer by £3500. The restriction of lighting hours had necessarily reduced the consumption, and their sale of gas was over 12 million cubic feet less, bringing them back to the position they occupied in 1914. The one bright spot was coke, which had been their salvation, and had produced £2000 more. The coke made at the Barnsley works was of very good quality. Economy had been the keynote for the year; but he warned them that this could be carried too far, and that the day was rapidly coming when more money would have to be spent on the upkeep of the mains. Coal was still going up. Their contracts were made for the coming year at a higher price; and this item would therefore show an increased cost. Fortunately, coke was in strong demand, and would again come to their aid. To put the position shortly, their profits were only about £100 less than last year—£7494, against £7598—and would enable them to pay the usual dividends. This was far happier than was the experience of some companies, who had had to increase their charges for both electric light and gas.

Water Supply of Dunedin.—The Imperial Trade Correspondent at Dunedin (Mr. W. T. Monkman) reports that the Dunedin City Corporation are about to ask for authority to borrow £140,000 for the purpose of carrying out a scheme for augmenting the city's water supply. The pipes and fittings will not be purchased until pre-war prices are restored; but meanwhile the necessary tunnelling, which will occupy a considerable time, will be proceeded with.

The Shipley Urban District Council have refused to comply with an application for an advance of wages to gas stokers, the extension of holidays, and increased terms for Saturday afternoon labour.

At a place in Yorkshire which must not be named, a Coroner's Jury have returned a verdict that the death of a young woman munition worker was due to toxic jaundice, as a result of inhaling trinitrotoluene.

The Directors of the British Gas Light Company, Limited, propose, at the half-yearly general meeting to be held this month, to recommend, subject to audit, a dividend at the rate of 10 per cent. per annum, with a bonus of 2s. 6d. per share, for the six months ended June 30, both less income-tax, and payable in October.

The loss on the Goole Urban District Council's gas undertaking last year amounted to £2700. The Gas Committee have under consideration the question of increasing the price of gas or charging meter-rents. The latter course is favoured, as many people use electricity, but retain gas-meters in case of emergency, and do not pay any rent.

There was a pleasant gathering last Saturday week in the grounds of the Hull station of the British Gas Light Company, when the employees and friends entertained about sixty wounded soldiers and sailors—a sum of £40 having been collected for the purpose. The arrangements were made by a Committee, of which Mr. C. Appelbee was Secretary. During the proceedings, the Engineer and Manager (Mr. John Young) expressed, on behalf of the staff, their pleasure at being able to offer the wounded men some little pleasure and recreation after the strenuous times they had passed through, and the brave British stand they had made against the enemy. They were, he said, proud of their soldiers and sailors. This was the second occasion on which the wounded have been entertained by the gas-works staff.

Considerable inconvenience and some amount of damage were occasioned on Monday of last week by an accident in connection with the Derby water supply—a large main running into the town from the Little Eaton reservoir bursting near the Breadsall Canal. About three-quarters of a million gallons of water went to waste, flooding the low-lying ground in the vicinity to a depth of several inches. While the resultant damage was not great, dislocation of the service was experienced over a large area; the subsidiary supply from the Derwent Valley source being brought into requisition. The pressure in the higher parts of the borough proved temporarily inadequate. The difficulty was obviated in the course of a few days; the main, the bursting of which is believed to have been due to a collapse of the packing, being replaced.

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